DOCUMENT RESUME

ED 458 095 SE 065 087

AUTHOR	McNelly, Deborah; Hoff, Douglas
TITLE	The Lamprey River Curriculum: A Teacher-Written, Teacher-Tested Social Studies Curriculum with a Science Component for Elementary, Middle and High School Students.
INSTITUTION	New Hampshire Univ., Durham. New Hampshire Sea Grant.; New Hampshire Univ., Durham. Cooperative Extension Service.
PUB DATE	2000-12-00
NOTE	177p.; Edited by Sharon Meeker. In collaboration with Lamprey River Advisory Committee and Lamprey River Watershed Association. Supported by the Greater Piscataqua Community Foundation and the Barbara K. and Cyrus B. Sweet III Fund. Accompanying videotape, "The River: The Lamprey through History," is not available from ERIC.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	MF01/PC08 Plus Postage.
DESCRIPTORS	Elementary Secondary Education; Environmental Education; Instructional Materials; *Lesson Plans; Pollution; *Rivers; Science Activities; *Science Curriculum; Science Instruction; *Social Studies
IDENTIFIERS	*Watersheds

ABSTRACT

This social studies curriculum with a science component contains two sections. The first section targets elementary schools and includes six lessons. The second section is intended for middle schools and high schools and contains four units. These two sections overlap with each other and can be used by teachers from any grade level. The content of the elementary school curriculum includes: (1) "The River Runs Wild and Scenic"; (2) "The River Flows through Life"; (3) "A Map of Our Own"; (4) "Stopping along the Lamprey: The Field Trip"; (5) "People of the River"; and (6) "A Message to the Lamprey River." The contents of the middle and high school curriculum include information on ongoing activities such as journal writing and field trips, background activities on watersheds and the Lamprey, research projects on wildlife, pollution issues, cultural and natural history, and land-use issues. The curriculum standards covered are also listed in each section. The featured videotape focuses on interactions between the river and people and the history of the river. (YDS)

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THE LAMPREY RIVER CURRICULUM

A Teacher-written, Teacher-tested
Social Studies Curriculum with a Science Component
for Elementary, Middle and High School Students

by

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DECEMBER, 2000

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Acknowledgements

We would like to recognize the work of our fourth grade teacher colleagues, Kris Lynes and Pam Bradley for joining us in the activities presented in this curriculum. Their suggestions were most helpful. Mr. David Michaud, principal at Mast Way School in Lee, New Hampshire, assisted the group in every way. The Oyster River School Board gave its support to the project, also. We appreciate very much the art, poetry, letters and other classwork the fourth-grade students have contributed to make this curriculum truly a group effort.

We also recognize that this project could not have come about without the support of the Greater Piscataqua Community Foundation and the Lydia K. and Cyrus B. Sweet III Fund, offered through a grant awarded to the Lamprey River Advisory Committee. The Lamprey River Watershed Association was an important collaborator on the project, as was the University of New Hampshire's Cooperative Extension and Sea Grant Extension programs.

We want to recognize the role Lee Selectman and Lamprey River Advisory Committee member Richard Wellington played, both in conceiving the video that inspired this curriculum, and for being an outstanding resource to the authors. Members of the local historical societies were most helpful, allowing us to peruse some of their historical materials. We particularly want to thank Phyllis Shenefiel, Richard Sanborn, and Kay Williams for their assistance in this regard. Sea Grant Communications Specialist, Steve Adams, assisted in the editing and printing process, and his help was very much appreciated. We also thank Margaret Watkins, staff for the Lamprey River Advisory Committee, who shared information, maps, and other resources with the authors as they wrote the curriculum.

Sam E.

PREFACE

The curriculum is designed to accompany a video, *The River: The Lamprey Through History*, produced for the Lamprey River Advisory Committee by Ideaworks, of Portsmouth, New Hampshire. The video focuses on the ways people have used the river for their livelihood and recreation in the past. The curriculum aims to assist educators and their students in studying the river as a vital part of their cultural heritage. We have broadened the scope of study somewhat by including exercises that focus on the river as a habitat for plants and animals.

Each lesson could conceivably be taught as a separate entity, although we feel that studying the river as a whole is a more valuable experience. The centerpiece of the curriculum is the field trip to sites along the river. We came to value the river as a vital part of our community through directly experiencing the river, as it winds from Northwood to the shore of Great Bay. The field trip and follow-up activities, generated by the educators, parents, and other community members, made this a very important part of the curriculum.

The curriculum is in two sections, with the first one intended for the elementary school and the second for the middle and high school students. However, they overlap a good deal, and teachers from any grade level will find it useful to look over the lessons and resources from both sections. There are tables of content for each section and separate resource lists that should facilitate the use of pertinent portions from both sections. The elementary portion has six lessons, or mini-units, with background for the educators preceding the activities for students. The middle and secondary school has four mini-units and is designed primarily for the teacher, with suggested activities outlined for the students. The looseleaf binder format makes it easy to remove and duplicate activities and data sheets in the elementary section. The format also encourages educators to add maps, interviews and activities that they develop themselves to more fully adapt the curriculum to their own needs.

Finally, if any of the authors can be of assistance to educators who use this curriculum, please do not hesitate to let them know.

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NH Social Studies Standards Supported by This Curriculum

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Lesson 2	**The River Runs Through Life**	11, 14, 15, 16
Lesson 3	**A Map of Our Own**	10, 11, 13, 14, 15, 16
Lesson 4	**Stopping Along the Lamprey**	6, 7, 8, 13, 14, 15, 16, 17
Lesson 5	**A Message to the Lamprey**	11, 12, 13

Curriculum Standard 6: Students will demonstrate the ability to examine the interactions of individuals, households, communities, businesses, and governments in market economies, including competition, specialization, productivity, traditional forms of enterprise, and the role of money and financial institutions.

Curriculum Standard 7: Students will demonstrate an understanding of different types of economic systems, their advantages and disadvantages, and how the economic systems used in particular countries may change over time.

Curriculum Standard 8: Students will demonstrate an understanding of the patterns and results of international trade, including the distribution of economic resources, imports and exports, specialization and interdependence, exchange of money, and trade policies.

Curriculum Standard 10: Students will demonstrate the ability to use maps, mental maps, globes, and other graphic tools and technologies to acquire, process, report, and analyze geographic information.

Curriculum Standard 11: Students will demonstrate an understanding of the physical and human geographic features that define places and regions.

Curriculum Standard 12: Students will demonstrate an understanding of landform patterns and water systems on Earth's surface; the physical processes that shape these patterns, and the characteristics of ecosystems.

Curriculum Standard 13: Students will demonstrate an understanding of the impact of human systems on Earth's surface including the characteristics, distribution, and migration of human populations; the nature and complexity of patterns of cultural diffusion; patterns and networks of economic interdependence; processes, patterns, and functions of human settlement; and the forces of cooperation and conflict that shape the human geographic divisions.

Curriculum Standard 14: Students will demonstrate an understanding of the connections between Earth's physical and human systems; the consequences of the interaction between human and physical systems; and changes in the meaning, use, distribution, and importance of resources.

Curriculum Standard 15: Students will demonstrate the ability to apply their knowledge of geographic concepts, skills, and technology to interpret the past and the present, and to plan for the future.

Curriculum Standard 16: Students will demonstrate the ability to employ historical analysis, interpretation, and comprehension to make reasoned judgments and to gain an understanding, perspective, and appreciation of history and its uses in contemporary situations.

Curriculum Standard 17: Students will demonstrate a knowledge of the chronology and significance of the unfolding story of America, including the history of their community, New Hampshire, and the United States.

NH Science Standards Supported by This Curriculum

Lesson 4 **Stopping Along the Lamprey** 1a, 2a, 2b, 2c, 3b, 6d

Curriculum Standard 1a: Students will demonstrate an increasing understanding of how the scientific enterprise operates.

Curriculum Standard 2a: Students will demonstrate an increasing ability to use measuring instruments to gather accurate and/or precise information.

Curriculum Standard 2b: Students will demonstrate an increasing ability to use technology to observe nature.

Curriculum Standard 2c: Students will demonstrate an increasing ability to analyze, synthesize, and communicate scientific information using technology.

Curriculum Standard 3b: Students will demonstrate an increasing ability to understand how environmental factors affect all living systems as well as species-to-species interaction.

Curriculum Standard 6d: Students will increasingly quantify their interactions with phenomena in the natural world, use these results to understand differences in scale in objects and systems, and determine how changes in scale affect various properties of those objects and systems.

Introduction to the Lamprey River

How did the river get its name? The Native Americans called it the Pascassick, a name that is now confined to its small tributary in Newmarket, and is generally written Piscassic. In 1639, in some records found in Exeter, it was called the Lamprill and Lamprel river. On a map drawn in 1680, a replica of which hangs in the Mast Way School library, it is labeled Lamper River. The lamprey eel, a fish that lives in the river in the early part of its life and then swims out to sea, returning only to spawn, may have been the source of the river's name. No one knows for sure.

The Lamprey River runs 47 miles from Betty's Meadows near Saddleback Mountain in Northwood Meadows State Park. It includes significant tributaries and lakes along its way. The river's watershed is 212 square miles and includes the communities of Candia, Raymond, Deerfield, Northwood, Nottingham, Epping, Lee, Durham, and Newmarket.

Its many dams speak to its mill heritage, for the river drops more than 600 feet in elevation on its way to the Great Bay and has many waterfalls that lend themselves to the development of waterpower for manufacturing. Raymond, Epping, Lee, Durham, and Newmarket were all sites of major water-powered industries such as grist, cider, cloth, and lumber mills.

As the river winds its way to the estuary, there are undisturbed places providing habitat for a variety of wildlife. A visitor to the river might be surprised by the slap of a beaver tail or the swish of an otter as it slides into the river. The 150 or more bird species that have been sighted along the river mean that one can see a variety of songbirds, ducks, and an occasional great blue heron. Migrating birds find its shores to be critical resting and feeding places as they move north or south. Stepping quietly along, one might encounter one of the state's six turtle species that reside in wetlands and uplands, along the banks of the river. There are fishers, weasels, porcupines, deer, moose and even an occasional black bear frequenting the woods that abound in the river corridor.

The Lamprey's waters are home to trout, largemouth bass, pike, and white and yellow perch, to mention a few of the species that attract fishermen from April through September. As Judith Spang mentions in her article in the *Lamprey River Watershed Guide*, "The Lamprey is a truly exceptional river.... It contains every type of stream and river fish you could expect to find in New England."

Freshwater mussels trail through the sand and indicate a healthy river environment with swimmable, fishable waters, little sedimentation, few sudden water withdrawals, and undisturbed shoreline vegetation to provide shade. Six out of the nine river mussels found in New Hampshire grow in the Lamprey, and because they are so sensitive to slight degrees of pollution, their presence assures

us that the Lamprey is healthy.

Canoers and kayakers look forward to "ice-out" every year when the river rises and provides a challenge to the most experienced paddler. Yet, there are many quiet, calm sections where one can paddle quietly along. Parks and conservation areas in many of the communities along the river are places to go for a quiet walk or picnic. Although there are few public beaches, swimmers find their way into the cool waters on a hot summer's day.

The value of the Lamprey was formally recognized a decade or more ago when New Hampshire included it as a "rural" river in its River Protection program. The Lamprey River Advisory Committee was formed at that time. Their work, in collaboration with other groups such as the Lamprey River Watershed Association and concerned citizens and town officials in many of the communities along the river has resulted in increased oversight and protection for the river. A part of the Lamprey River in Newmarket and all the portions in Durham, Lee and Epping have been designated within the National Parks' Wild and Scenic Rivers program. This protects local control of the river in those communities. Signs at highway crossings along those parts of the river inform the public of its wild and scenic status. Some funds have been secured as a result of these efforts to assist in development of recreation areas for the public and land protection strategies for homeowners along the river.

Still, the Lamprey is vulnerable, particularly to the population pressures that are fast developing in New Hampshire. The more people move into the area, the more the river is subject to all sorts of pollution. Point source pollution, that comes from specific sources such as discharge pipes from homes or factories, does occasionally occur on the river.The wastewater treatment plants in Epping and Newmarket are the only two regulated discharge points. Both release treated wastewater directly into the Lamprey. Non-point source pollution which comes from failed septic systems, construction sites, dumps, lawn run-off, fields and streets, is washed into streams and the river with every rain.

The Lamprey mirrors the rivers of New England through its historic connection to people who depended upon rivers for their livelihood and recreation. From the time the last glacier covering this area melted 12,000 years ago, people have utilized the river's resources and continue to do so. It is hoped that through study of this river young people will come to understand the value of rivers to them personally, and do their utmost to preserve them for themselves and future generations.

The River Runs Wild and Scenic

1.1 Thinking and Talking About Rivers.

Overview:
Encourage the students to relate their own experiences with rivers and develop a readiness to begin to study the Lamprey River through discussion, pictures of rivers, etc. Bring in appropriate information that you have from other sources. Help the students organize their information and questions. In the second lesson, begin to develop knowledge of the Lamprey through map-reading activities. The three maps used in this section: a blank map of New Hampshire, a detailed map showing the rivers, and a map of the Lamprey River watershed, are at the end of this lesson.

Focus:
What is interesting about a river?

Learning Objectives:
The students will:
- recall and discuss knowledge of rivers from their experience.
- connect previous knowledge with information and ideas about rivers

Duration:
2 hours

Materials:
___*A River Ran Wild* by Lynne Cherry
___6 sheets of large chart paper
___markers
___materials to make student journals (some may prefer to use folders)

Procedure:
1. Ask your students to share what they know about rivers. Prompt the discussion with questions such as:

Do any rivers run through your town?
Are there any rivers near your school or your home?
Have you ever visited a river? What did you do there?
How did most people use rivers in the past?
Are they as important to us now as they were in the past? Why ?
How are rivers important to other living things?

2. Record your students' ideas on charts under the following topics. What do we know about rivers? What would we like to learn? How are rivers used today? How did people use them in the past? How are rivers important to other living things?

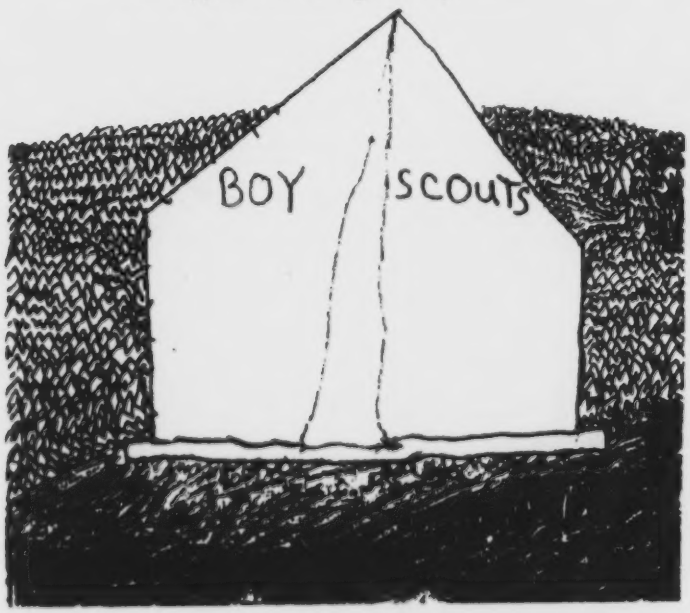
3. Read *A River Ran Wild* aloud. Then ask your students to make connections with information in the book to the discussion you had previously. As they share their thoughts, add more ideas to the different categories.

4. Have your students create and label their *"The River: The Lamprey Through History"* journals. Then have them write about their memories of rivers. (You may want them to share any other memories they have of rivers before beginning to write.) When everyone is finished writing, have the children read aloud or share portions of their memories.

THE RIVER

by Chelsea K.

Peaceful and gentle is the sparkling stream.
Soft music glides over the river bed.
While white water crashes through the canyon.
Twisting and turning with booming thunder,
The river from beginning to end,
And somewhere in the middle
Splashing, dashing, castles of foam.
The sapphire stream goes on forever.



1.2 Where is the Lamprey River?

Overview:
The Lamprey River stretches 47.3 miles from its headwaters in the Saddleback Mountains at Betty's Meadows in Northwood to the shores of Great Bay in Newmarket. It is the fourth largest river in the state and its watershed covers 212 square miles. It drops 600 feet in elevation on its way to Great Bay and discharges 278 cubic feet of water per second. Its major tributaries are Hartford Brook, North Branch River, Onway/Governors Lakes tributaries, Pawtuckaway River, North River, and the Little River. Towns in the watershed include Northwood, Candia, Raymond, Nottingham, Deerfield, Epping, Lee, Durham, and Newmarket.

Focus:
Locating the Lamprey River in the state.

Learning Objectives:
Students will:
• demonstrate the ability to gain a variety of information from several maps.

Materials:
___Blank outline maps of New Hampshire
___Detailed maps of New Hampshire showing the Lamprey River (1 for 2 children)
___Maps of the Lamprey River watershed, (1 for 2 children)
___Crayons or colored pencils
___Charts to record class discussion items.

Procedure:
1. Ask your students to share their ideas about the location of the Lamprey River. Where can they see the River in your town? Does it flow through any other towns? Which ones? What else do they know about the river's location? Where do your students think the river is in the state?

2. Give each child a copy of the blank New Hampshire map and ask them to draw the location and extent of the Lamprey River. (They can also try to place the river on a map at the end of the project for evaluation.)

3. Pass out detailed maps of New Hampshire which show the location of the Lamprey River. Ask your students to work in pairs and find the river on these maps, trace it with crayons, and then compare their drawings of the river on the blank map with its true location. Have them rank their drawings: close, somewhat close, not close.

4. Hand out maps of the Lamprey River watershed and have your students trace the length of the river with crayons. Provide them with string and a ruler to make measurements on the map. They can be quite accurate if they work

together to hold the string down all along the path of the river from beginning to end and measure the string. They can compare their measurements with the legend at the bottom of the map.

5. Introduce the concept of a watershed as the entire land surface that drains into a river, lake, bay, etc. Have the students study the watershed map, and then ask them to decide what they can learn about the river by looking at it. Generate a list of topics. Write the topics on chart paper or on the board.

6. Discuss the term "data" with the students and have them label the next page in their journals "Map Data."

7. Ask them to write the topics that were generated in #5, leaving several lines after each topic, in their journals. Encourage them to record the information they gathered from the maps. Topics can include: length, direction, tributaries, towns in the watershed, where it crosses their town, beginning and end of the river, etc.

8. Now give your students time to gather as much information as they can from the maps.

9. As a whole class, compare what was discovered about the river using the watershed maps. Students may fill in information they missed. During the discussion, add information to the charts begun earlier in part 1.1.

THE LAMPREY

by Greg G.

From Northwood to Great Bay,
The Lamprey flows.
From places far away,
Past houses and roads it goes.
The creatures in the Lamprey
They swim or crawl or fly.
They depend upon the river
Until the time they die.

Lamprey River Map Data

Student's name_____ **Date**_____

How long is the river? _____miles.

What general direction does it flow?_____

Does it change direction? _____ Describe how. _____

_____

Where does the river start?_____

Where does it end?_____

Where is the river located in the state?_____

_____

Does the river have tributaries? If so, name some. _____

_____

What other things did you learn from the map?_____

_____

_____

Raging Current

by Sam H.

The current is swift with castles of foam,
Sparkling, splashing, twisting and raging.
But some of the river isn't in motion. It's not
Splashing or rolling or tumbling or thrashing.
It sits in the pond, not moving at all,
Waiting to move South to the next waterfall.
Near where it sits were mills and the falls.
Producing food for the villages all.
After the water flows over the obstacles
And through the towns,
It ends up in the sea.

Lesson 2

The River Flows Through Life

Overview: This lesson focuses on the many ways the people along the Lamprey River have used it in their lives from the past to the present. Students need an understanding of the roles the river has played throughout history so that they will understand why they need to help ensure the health and vitality of the river in years to come. In this lesson students will be able to see and hear about the communities through which the Lamprey River flows. They will view a video and complete viewing activity sheet to increase their knowledge and appreciation of the Lamprey River.

Focus: How have people used the river to benefit their lives through history to the present?

Learning Objectives: Students will be able to:
- identify the communities through which the Lamprey flows.
- explain different uses made of the river by people and other living things.
- identify some types of wildlife found along the Lamprey.

Duration: 1 hour

Materials:
___Copy of *River Story: The History of the Lamprey River* video
___Television and VCR
___Copy of the Video Viewing Activity sheet per student
___Sheet of paper per student
___Pencils

Previewing Activities:
1. Have students look at the individual maps they created as part of Lesson 1 (or give them maps showing the rivers of the state.) Ask students to discuss what they discovered when they completed the maps or what they noticed about the Lamprey River on the maps they have been given.

2. Have students generate questions they would like to have answered about the Lamprey river on a separate sheet of paper. Collect the papers to be used after the viewing of the video.

Focus for Viewing: Read through the questions on the viewing sheet with the students and ask them to pay close attention during the video in order to complete the activity.

Video Viewing Activity

Begin the video at the start of the tape.

PAUSE: When the watercolor of the flying geese appears on the screen and the narrator completes his sentence, have students record the three reasons the river was essential in early times. Resume play.

PAUSE: When the black-and-white photo of the Native American appears on the screen, ask students to complete the second question regarding how long ago Native Americans lived along the Lamprey River. Resume play.

PAUSE: As the small painted turtle begins to move across the screen, have students list five different animals they might find along the Lamprey River. Allow time for students to share answers to ensure all of the animals shown are noted. Resume play.

PAUSE: After the fawn gets up and begins to move across the screen have the students answer the question concerning the community in which the Lamprey River begins. Note that the question is asking for the community and not the exact location. Resume play.

PAUSE: When the black-and-white photo with the green box titled Deerfield/ Recreation appears, have students predict two ways the river may be used for recreation. Resume play.

PAUSE: When the black-and-white photo with the green box titled Raymond and Candia/Early Mills appears, have students discuss whether or not their predictions were correct. Resume play.

PAUSE: After the narrator says, "... many lines linked New Hampshire towns," and the railroad station appears in the background, have students list two ways New Hampshire people used mills along the river. Resume play.

PAUSE: After the block of ice is directed into the icehouse by the man sitting along the chute, ask the students to record their ideas as to why ice cutting was important to the lives of people living along the river in the late 1800's and early 1900's. Resume play.

PAUSE: After the narrator says, "... straddled the entire river and used a horizontal waterwheel," have students note on their viewing papers the only location along the Lamprey where this situation was located. Resume play.

PAUSE: After the narrator says, "... that employed 15 people," and the water is shown flowing over the dam, have students list three different items which were

manufactured at the Wiswall Dam site. Allow time for students to share their ideas. Resume play.

PAUSE: After the narrator says, "... river town of Newmarket." Have students complete the question regarding where the Lamprey River ends its journey to the ocean. Resume play for the completion of the video.

After viewing of the video is complete, redistribute the question sheets generated earlier. Ask students if there are still any questions that were not answered as a result of watching the video. In the event that there are, determine the relevance of future research by your students or provide the answers yourself. The listing of resources made available in the appendix may be useful.

Be sure to show the video without interruption at some time during the unit.

River Changes

by Sam E.

Sometimes the river changes in many, many ways.
Like it could slide or crash or collide,
Or sometimes it could be smooth and soft and calm.
It's really, really strange how these things are so,
But that's just the way it goes.

The Waterfall

By Jonathan.

The river is winding like a snake,
Twisting and flowing into a clear lake.
The lake turns into a splashing and wild waterfall,
At the bottom of the waterfall,
The river becomes bubbling, crystal dewdrops...
And the river shivers.

Video Viewing Activity

Student's name_____ **Date** _____

Listen carefully to the video *River Story, The History of the Lamprey River* that your teacher is going to show you. When the tape is paused, answer the appropriate questions below.

1. List the three reasons the Lamprey River was essential in early times:

   a) _____

   b) _____

   c) _____

2. How many years ago did the Native Americans live here? ____

3. List five different animals you might find along the Lamprey River:

   a) _____

   b) _____

   c) _____

   d) _____

   e) _____

4. In which community does the Lamprey River begin?

   _____

5. Predict two ways that the Lamprey River might be used for recreation. (How would you like to use the river?)

   a) _____

   b) _____

6. List two ways New Hampshire people used mills along the Lamprey River:

a) _____

b) _____

7. Why do you think that ice cutting was so important to the lives of people living along the Lamprey River in the late 1800s and early 1900s?

_____

_____

_____

8. What is the only location along the Lamprey River at which a dam straddled the entire River and a horizontal waterwheel was used?

_____

9. List three different items that were manufactured at the Wiswall Dam site:

a) _____

b) _____

c) _____

10. In what community does the Lamprey River end its journey to the sea?

_____

11. Use the space below to write about the two facts you found to be the most interesting about the Lamprey River.

Lesson 3

A Map of Our Own

Overview:
This lesson focuses on the creation of a large area map of the Lamprey River watershed that includes all of the communities through which the River flows, significant historical and local events, and sites that have played a role in the Lamprey River's history. Animals and plants that the students have noted from the video may be added also. Be sure that the students understand that a watershed is land from which all the water drains into a certain stream, river, lake or other water body. On its way, the water travels across farm fields, forest lands, parking lots, lawns, highways, town streets, school playgrounds, and fields. Students will be encouraged to work collaboratively to produce the map for a classroom or hallway display. As the students learn more about the river, they can add items to their part of the map and display.

Focus:
What were some of the important events, places and people in history to the present time in the Lamprey River watershed?

Learning Objectives:
Students will be able to:
- generate a portion of a large map.
- contribute important information for display on the map.
- identify tributaries and other important land features along the River.
- note locations of historical events along the Lamprey River.

Materials:
___Overhead projector with overhead copy of the watershed map *OR*
___Opaque projector and copy of the watershed map (Lesson 1.2)
___*River Story: The Lamprey Through History* video
___Television and VCR

For Each Working Group
___large butcher or bulletin board paper
___masking tape
___pencils
___colored markers

Procedure:
1. Divide your class into seven working groups. Each group should be assigned one of the seven communities through which the Lamprey flows.

2. Using an opaque or overhead projector, project the map onto a wall surface that has been covered by a large piece of butcher or bulletin board paper. Demonstrate for the class how to outline the boundaries of a single community, and then how to trace the Lamprey River and its tributaries onto the butcher paper.

3. In turn have each group trace their community boundary, the Lamprey River through their community, and any tributaries or contributing water sources that flow from their assigned community onto the paper.

4. While each group in turn is working with the enlargement, other groups should be reviewing information they have learned about their communities through the video, and deciding how that information could be added to the large Lamprey River map being created. Making available the list of resources noted in the appendix will be helpful.

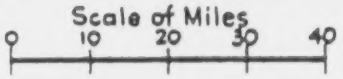
5. After each working group has completed their segment, piece the segments together for a hallway or classroom display of the river. Students may wish to present the map and its progress to other classes.

6. Throughout the duration of the unit, students should continue to add information to the large map so that it becomes a visual memory of their study. Examples might include the location and names of dams created, garrison houses built, activities that occur along the river, sites of artifacts discovered or even a student's favorite swimming hole. Students should be encouraged to include both historical as well as current information. The more information added, the more exciting the river becomes to view and discuss. If possible, keep the video available for students to use throughout this portion of the project.

Blank Map of New Hampshire

RIVER I

NEW HAMPSHIRE



Lamprey Watershed Map

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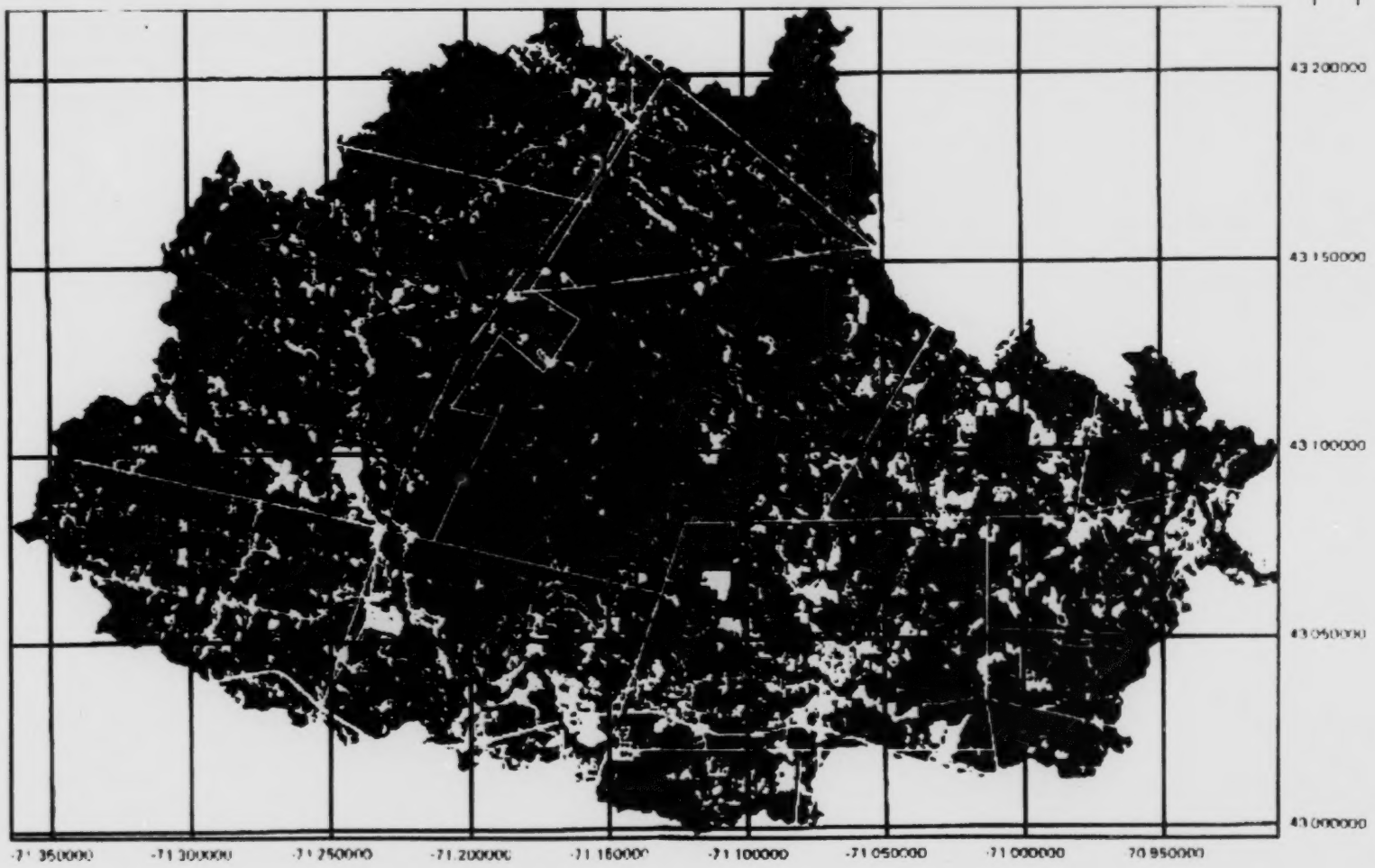

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Stopping along the Lamprey Field Trip

Overview: This lesson focuses on taking children to the Lamprey River and allowing them to experience the River from a number of different locations. Included in the lesson are suggestions for completing several field studies that allow students to build and use a variety of monitoring tools to measure physical, chemical, and biological properties of the river.

Learning Objectives: Students will be able to:
- enhance their understanding of the river and its watershed
- build monitoring tools for use on the Lamprey River
- use monitoring tools appropriately to sample basic parameters of water
- collect samples and make observations of animal and plant life along the river

Materials for Each Class:
___Bus or transportation
___Permission slips
___First Aid Kit
___Name tags for everyone (including chaperones)
___Moistened towelettes to clean hands
___3 plastic containers with covers, to take water samples.
___Ziploc bags (large and small) for leaf, rock, and dirt samples
___Pencils
___Clipboards for attaching data sheets
___Dissolved oxygen kit and bucket with rope attached to the handle for collecting water
___pH kit
___Measuring rope for current measurement
___Markers (permanent) to label bags
___Laminated map of the Lamprey River watershed
___Data collection sheets
___Global Positioning System instrument (optional)
___Appropriate monitoring tools (see individual lists for each activity)
___Binoculars
___Field guides for trees, plants, insects, birds, etc.
___Laminated experiment sheets
___Cell phone (optional, but very handy in case of emergency)

Procedure:

1. Select the sites for the field trip and visit them before taking the students on the trip. Time how long it takes to get from one location to another and remember that it generally takes about 5 minutes to load and unload buses with passengers. Be sure that you have written accurate directions for the bus driver.

2. Minimally, classes should view the headwaters of the Lamprey at Betty's Meadows in Northwood, and the closest point accessible to the end of the Lamprey River in Newmarket, at Heron Park. These sites plus additional sites are listed in "Notes for the Teacher" at the end of this lesson. **Teachers are urged to seek out safe, interesting points in their own towns and visit them to check for suitability and safety before taking their students there.**

3. Inform the town offices that control sites where you may be visiting. Make arrangements for gates to be opened if necessary. Sometimes local conservation commissions can put you in touch with people in the community who can act as naturalists for your field trip.

4. Plan for bathroom and lunch stops along the way.

5. Arrange for transportation to chosen sites for the field trip. Often the bus can be provided free of charge if you plan your trip within the time limits that the bus will be available to the school.

6. Contact parents and other community people to act as group leaders for student research teams. One adult for every 3-4 children is a good ratio. Prepare a written field trip schedule for them and be sure they understand what they are to do on the trip. If possible, invite them in to assist the students when they are practicing their field trip experiments in class. It may also be useful to invite them to view the video tape with the students as preparation for the field experience.

7. Review information about the river, goals and instructions before the field trip. Be sure the students know what group they will be in and who their chaperone will be.

8. Upon arrival at a site, have everyone gather together to hear a short site description, a review of safety measures, and purpose of observations and experiments at that particular site. Then have them get into their groups before going to the location.

9. **Important:** follow up the field trip with classroom activities that involve identifying and classifying specimens, using microscopes to look at water samples, using magnifying glasses to look at soil samples, etc. Use the data sheet records or other notes taken on the field trip to add information to the charts and watershed map created in previous lessons. Discuss relationships between plants and animals and the environment. Invite chaperones to assist the students in class. They are often interested in coming to the classroom to help with follow-up activities.

Field Trip Suggestions

(Consult the Lamprey River Watershed Guide for other ideas for field trip sites along the river.)

Some Suitable areas:
Northwood Meadows State Park (headwaters at Betty's Meadows)
Friese's Pond—Deerfield * (The elementary school is very near this location)
Raymond School—Raymond *
Wiswall Dam—Durham
Foss Farm—Durham *
Sliding Rock Park—Newmarket
Wadleigh's Falls—Lee (with the permission and assistance of the Meekers, who live nearby.)

Mast Way School's field trip included four locations:
Northwood Meadows State Park; John Folsom Conservation Area in Epping;
Meeker residence at Wadleigh Falls in Lee; and Heron Park in Newmarket.
Notes from the participating teachers are in ***italics*** after each site.

Directions:

1. Headwaters, Betty's Meadows, Northwood Meadows State Park
From the Lee Traffic Circle travel west on Route 4.
In Northwood turn left onto Route 43. (The library is on one side).
Go 1 mile on Route 43.
Turn right onto Old Mountain Road.
Drive to the end of the asphalt (about 1.5 miles) and park.
Caution: turning the bus around here is difficult, but it is possible.
It takes about 15 minutes to travel there from the Lee Traffic Circle

Mast Way School classes spent 45 minutes collecting data at the headwaters. Students easily conducted oxygen, acidity, temperature, and current speed tests at this site. There was no current, but testing it offered a good comparison for data that was collected at other locations. Water samples we collected contained daphnia and many other small organisms which were interesting to study later in the classroom. Because of the dam at one end, the water was very still. The vegetation included water lilies and other swamp-like plants that provided a good contrast for those in swifter-moving waters at later field trip sites. We found signs of animal life: deer and rabbit tracks, woodpecker holes in trees, and beaver and muskrat homes in the water or banks.

2. John Folsom Conservation Area, Epping
Return on Mountain Road and turn right on Route 43.
Turn left onto Routes 107 and 43 at the stop sign.
Soon after this turn the bus will pass Freese Pond and Dam.
Stay on Route 107.
Bear left where Old Route 101 and 27 joins Route 107.
In Raymond, take Route 27 to West Epping.

Turn right at the sign for the John Folsom Conservation Area.
The Conservation Area is a short distance down this road.
Drive slowly!
It takes about 35 minutes to drive from the headwaters to the John Folsom Conservation Area.

Small pine trees have been planted at the entrance of the Conservation Area. The path passes through a wooded area, crosses a biking or hiking trail that was once a railroad bed, and then enters another wooded area before reaching the river. We found clumps of cinders: evidence that trains once passed through this site. As we came near the old railway, we saw many blackened and dead trees standing or laying on the ground. Insects had attacked them, birds had probed for insects, and larger animals had made homes in or beside them. Hemlock, red pine, cedar, maple, oak, ash and birch trees live there. Many types of mushrooms and other fungi grow closer to the river. Witch hazel was everywhere and in bloom for our October visit. Colonists named this shrub "witch" hazel because they thought it was unnatural for any plant to be blooming in the fall rather than in the spring. Witch hazel yields an astringent still used today. Our classes spent about 1 1/2 hours at the Folsom site. Students conducted oxygen, acidity, temperature, and current speed tests here, and then collected water samples for viewing with microscopes back in the classroom.

Caution: *Do not let the students walk along the railway because they will come to an old railroad bridge that is very dangerous. The railings and floor of the bridge have many open holes. We didn't even go within sight of it!*

3. Wadleigh Falls at the Meeker residence in Lee
(Mrs. Meeker was a naturalist for us and we parked our bus in the driveway and walked down to the Falls. Permission to use any private property must be obtained before planning to use it as a part of the field trip.)

Directions:
Return to Route 27, and turn right toward Epping village.
Proceed to Route 125.
Turn left toward Lee.
Turn right on to Highway 152.
Turn right and cross the bridge over the Lamprey.
The Meeker house is the second house on the left. (It is yellow with a red barn behind it.)
Park in the circular drive beside the house

After getting off the bus, our classes were re-organized into their groups and walked down to view the falls, take samples and do experiments and make observations in their notebooks. It is important to have the chaperones supervise the students very well in this location, since the river flows quickly here. This is not an appropriate site when the river is high in the spring. It is available only with permission and presence of Mrs. Meeker. The students were excited about seeing the supports for an old flue, parts of the dam, the island where Native Americans

camped when they came to fish, and the depressions in the bank where vats holding chemicals to prepare leather were placed. There was a small pile of old leather scraps, remains of an old wagon, bits of crockery, fishing line, beverage cans, and other evidence that humans have used the area from the past to the present time. Wadleigh Falls is the only known site along the Lamprey where a horizontal water wheel was used. We stayed there about 45 minutes.

4. Heron Point Sanctuary (near the mouth of the river), Newmarket

Leaving the Meeker driveway, turn left on Route 152 in Lee and continue to Newmarket.
In Newmarket, turn left onto Route 108 and continue over the bridge.
Immediately after crossing the bridge turn right onto Bay Road.
Drive about 1/2 mile until you come to a mobile home park.
Turn right and drive into the mobile home park.
Drive a short distance to the Heron Point Sanctuary.
Turn right onto the dirt road and continue to the parking lot.
Gather and study the sign with a map of the sanctuary.
Then, keeping the students on the upper outlook platform, look across the river at the Newmarket mills.
This drive takes about 30 minutes.

We only stayed here for 15 minutes, but suggest that a longer period of time be allowed for this stop. Behind the map a wooden stairway and a large platform. From the platform you have a great view of the Newmarket mills and the Lamprey River. We walked to the platform, then talked about the history of this site and observed the differences in the river. (We didn't conduct any tests here because the banks are steep but you could conduct tests at the public landing on the other side of the river at the Newmarket public boat landing next to Joyce's Kitchen. There you would see the historic fish wier and a kiosk describing town history, including old photos and maps.) The vegetation along the trails was different than at the other two sites. Huge boulders were scattered throughout the area and a thick stand of hemlocks covered the hillside. (It would be useful to carry a map that shows the river ending in Great Bay.) The map in the parking lot showed the location of a Native American grinding stone used to grind seeds for flour. Looking for the grinding stone would be a fascinating ending to your trip.

The River

By Bradley W.

The river,
The river,
The ongoing rivr.
It winds its way through
Hills and valleys,
Bubbling its way through
Its rocky bed.
It sometimes flows quietly,
While other times, roars madly.

Teacher's Guide for Experiments and Observations

Overview: These experiments focus on physical and chemical characteristics of the Lamprey River which students can observe, measure, record and compare. During the pre-field activities students have an opportunity to practice measuring skills or make specific equipment to use in the field. After gathering and recording information in teams, students have the opportunity to share the data they have collected to develop a "bigger" picture of the significance of what they have discovered.

Learning Objectives: Students will be able to:
- build and use a number of monitoring tools,
- observe, measure and record physical, chemical, and biological properties of the Lamprey River, and make accurate statements about their relationships.

Preparations: During the pre-field and field experiments students will measure the following properties of the Lamprey River in one or two locations and record their findings on the data sheets at the back of this section.
- Current speed (stopwatch, measured rope, 20 meters long)
- Air and water temperature (2 thermometers with both Celsius and Fahrenheit scales
- Dissolved oxygen (La Motte Dissolved Oxygen tablets kit or CHEMets Kit)
- pH (pH test strips or LaMotte or Hach pH kit)
- Transparency of water (Secchi disk)

Procedures:
Pre-field experiment:
1. Collect all the necessary materials to conduct the experiments and study the Teacher Background information preceding each Student Experiment.

2. Discuss with the class the characteristics they are going to measure and why they are important to animals and plants that live in the river habitat.

3. Divide the class into 5 research teams. Each group will choose a **recorder** to write down information on the data sheet, a **technician** to be responsible for the equipment before and after the experiment, two **scientists** to conduct the experiment, and a **presenter** to share the information with the rest of the class.

4. Distribute the appropriate experiment information, equipment, and Data Sheet #8 on a clipboard to each group. Laminating the experiment information on stiff paper is helpful and can be easily handled by the students in the classroom and the field.

5. If possible, have an adult work with each group. Inviting the chaperones who will be going on the field trip to come in and assist the students in the classroom is a good opportunity for them to learn the experiments before they are expected to help the students at sites along the river.

6. Allow time for the class to come together and report on and discuss each experiment. Help them understand the relationship of their experiment to the animals and plants that live in and along the river. Ask what the children think the data might be telling them.

7. Examine the other observation sheets at the end of this lesson and discuss them with the children. Emphasize using their senses to help make observations.

Field experiment:

1. Prior to leaving on the field trip, collect all the necessary equipment and organize it according to the experiment in which it will be used. The technician for each of the five groups can be responsible for the equipment, with the assistance of the adult chaperone.

2. While at the field site be sure to have adequate adult supervision (at least one adult for each experiment team.) As even the cleanest-looking water can be contaminated make sure students do not eat anything while they collecting samples and conducting the experiments. Use handiwipes to clean hands after the experiment phase is complete.

3. As each experiment is conducted, be sure that each person records the necessary information on Data Sheet #8. Conduct the experiments at different sites so that results can be compared later.

4. After the experiments have been conducted, students can be given observation sheets to help them further study the site.

5. It is helpful to briefly share and summarize each site, with the help of the students, before they get back on the bus to go to the next site.

6. When the class has returned from the field trip, bring them back together in the next day or two to talk about the data they have collected from the experiments and observations. Compare and contrast results of experiments at different sites and discuss observable differences such as current speed, water temperature and dissolved oxygen levels, etc. Record the results in a variety of ways: on the charts that have been developed in other lessons, on the watershed maps, using the computer to graph and compare data, and through creative interpretation in dioramas, poems, stories, etc.

TEACHER BACKGROUND—WATER AND TEMPERATUE

Background: Air and water temperature are important for the animals and plants living in, or near, the river. Air temperature has mainly a seasonal effect on river water temperature. It may be weeks before a change in air temperature will affect river temperature.

Temperature affects the functioning of living things. When water warms, the temperature inside the so-called "cold-blooded" animals warms. Their metabolism increases, making them breathe faster, and digest food faster. As a rule, for every 10 degrees Celsius in temperature there is a doubling of metabolism. This is true only to a point, however, because high temperatures also decrease the supply of dissolved oxygen in the water. Winter temperatures generally do not get cold enough in the river to affect most fish, but there are some species that can survive in very cold lakes and in the ocean, by manufacturing a type of "anti-freeze" which lowers the freezing point of body fluids.

Air and water temperatures affect plants and many of them die back and become dormant until warmer temperatures come in the spring. Others may die completely, depending upon seeds to reproduce when the temperatures warm.

Temperature is measured both on the Fahrenheit scale and the Celsius or centigrade scale in this country. Our weather is reported in Fahrenheit, but most scientific measurements are measured on the Celsius scale. This makes for some confusion for the students and needs to be explained. The Fahrenheit scale ranges from 32 degrees (freezing point of water at sea level) to 212 degrees (boiling point of water at sea level). The Celsius scale measures the same thing from 0 degrees to 100 degrees. The students can read both scales and record both measurements in their notebooks or data sheets.

Preparation: At this station the students will test water samples of warm and cold water with thermometers that register Celsius and Fahrenheit.

Have at least 2 Celsius Fahrenheit thermometers, 2 containers of water of different temperatures labeled A and B, a sponge to wipe up drips, a data sheets and clipboards, and pencils ready for the group of five students.

Have the students examine the thermometers and talk about the different scales. The words Fahrenheit and Celsius should be written on the board and explained. Be sure that each student gets to do the experiment and record the data.

Discussion: Encourage the students to develop questions that they have about the experimental results. List the questions and lead them to some of the questions they will be considering when they do the field experiment. These are listed at the end of the student experiment on temperature. Use the questions during the follow-up discussions at the end of the field trip.

Student Experiments —Water and Termperature

Overview: In this experiment your team will take the air and water temperatures at your chosen site along the Lamprey River. Temperature is important to living things for many reasons. When the water temperature is warmer, fish move faster and grow faster than when the water is colder. Air temperature is important too. It can cause the water to become colder or warmer. We should remember, however, that air temperature changes much faster than water temperature can. For example, it takes several days or even weeks of warmer air temperatures to make water become warmer.

Focus: What are the air and water temperatures at your chosen site?

Materials:
For the pre-field experiment:
1 Celsius/Fahrenheit thermometer for each member of the team
Cup of warm water
Cup of cold water
Data sheet with clipboard
Pencils

For the field experiment:
1-2 Celsius/Fahrenheit thermometers
Fishing line
Duct tape
Data sheet with clipboard
Pencils
Bucket with a rope attached to the handle

Procedures:
Pre-field experiment:
1. Hold a thermometer in the air until the mercury (the red line) stops moving. Write down both the Celsius and Fahrenheit readings on your data sheet.

2. Hold a thermometer in the cup of warm water until you can take a steady temperature reading. Write down the Celsius and Fahrenheit

readings on your data sheet.

3. Hold the thermometer in the cup of cold water until you can take a steady temperature reading. Write down the Celsius and Fahrenheit readings on your data sheet.

Field experiment:

1. Hold a thermometer in the air until you can take a steady temperature reading. Write down the Celsius and Fahrenheit readings on your data sheet.

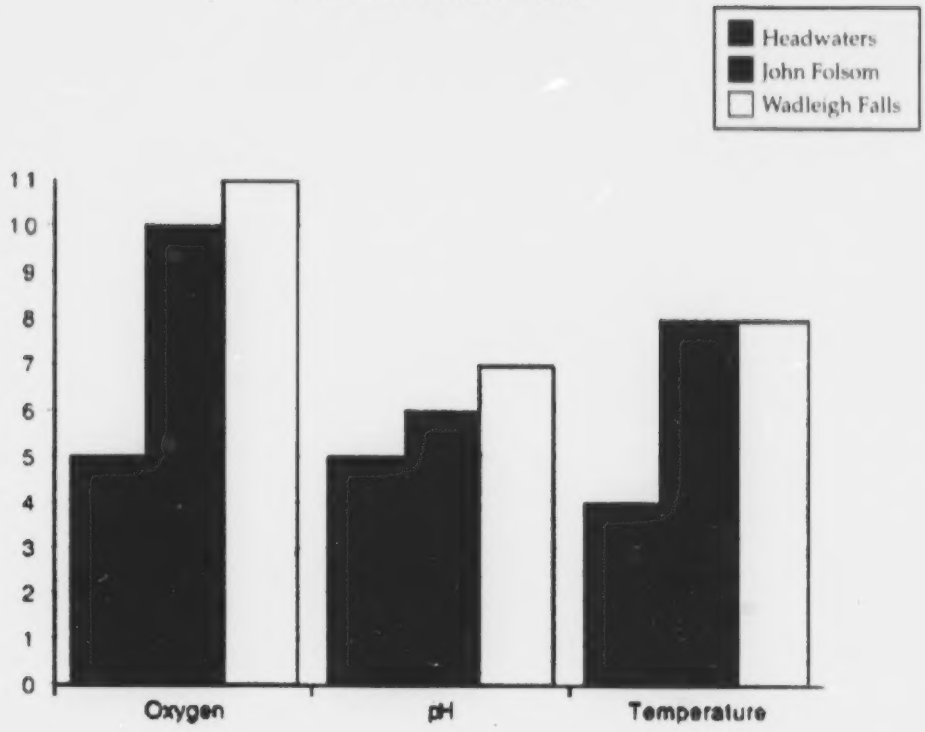
2. Get a sample of water in the bucket or put the thermometer directly into the river. Hold a thermometer in the water until you can take a steady temperature reading. Write down the Celsius and Fahrenheit readings on your data sheet.

3. If you want to get a water temperature reading at a deeper spot you can modify your thermometer as follows: cut some fishing line several meters long. About 15 centimeters from the end of the line, tie the line around a small rock or pebble. Wrap a piece of duct tape around the line and rock to hold them in place. Now tie the thermometer to the very end beneath the rock. Secure the thermometer with a piece of tape. Holding the opposite end of the line, carefully cast the thermometer into the water. The rock will act as a weight to keep the thermometer submerged. Keep the thermometer submerged for as long as it took to obtain a steady reading in the shallow water. Write down the Celsius and Fahrenheit readings on your data sheet with a note saying that the temperature was taken at a deeper level.

Discussion:

1. How does air temperature relate to water temperature?
2. Over the course of a day, which do you think varies more?
3. How are water and air temperatures good indicators of the River's ability to sustain life?
4. If you took the temperature of the water at a deeper level, was it different than the temperature at the surface? Why or why not?
5. Do all fish prefer the same water temperature?

LAMPREY RIVER DATA



Teacher Background—Dissolved Oxygen

Background: Animals in a water environment require oxygen in order to breathe. Some of the free oxygen in the water comes from photosynthesis of plants as they take carbon dioxide out of the water and replace it with oxygen. Most of the free oxygen dissolves into the water from the atmosphere at any point where water interfaces with air. Fish and invertebrates that live in the water breathe by means of gills. The oxygen diffuses into the gills as carbon dioxide and other gases used in their metabolism are expelled. Water contains very little oxygen compared to that in the atmosphere.

In water there are usually less than 12 parts per million parts of water (12/1,000,000) as compared to 21 parts of oxygen per hundred parts of atmosphere (21/100). Fish and other animals that live in the water need at least 4-5 parts of oxygen per million parts of water, or they have difficulty breathing and may suffocate.

Dissolved oxygen rates are much affected by temperature. Cold water with its slow-moving molecules holds more dissolved oxygen than warm water, whose faster-moving molecules push some of the free oxygen atoms into the atmosphere. Waves and fast-flowing waters also create opportunities for oxygen from the atmosphere to dissolve into the water. After the students complete their experiment be sure to discuss how water temperature and the speed of water movement relate to oxygen rates.

Preparation: The test kits all require a water sample of a specified amount and the adding of several chemicals to the sample to allow the free oxygen atoms to be counted. The simplest test kits are the CHEMette kits. You can purchase a CHEMette kit with 100 tests for $40 from CHEMetrics, Inc. The La Motte company has a test that simply requires placing a tablet containing the necessary chemicals in a sample of water, watching the water change color, and comparing the color to a color chart which costs about $20. Either would be easy to use. See the Resource section at the end for addresses.

There are other La Motte or Hach dissolved oxygen kits that contain more detailed work with chemicals, but these are not recommended. If you use either of them, be sure the students have safety glasses on and that they work with protective rubber gloves. They should use the kits only with close adult supervision. Directions for all the tests are in the test kits. They vary according to which test is used.

1. Explain Data Sheet #8 to the students and distribute them with clipboards for use to each group.

2. Have two water samples from different sources available for the students to test in labeled containers.

Discussion:

1. How does oxygen get into the water? (Plants photosynthesize and give off oxygen. This oxygen dissolves in the water. Some mixes in from the air where the water touches air. On windy days, or if the river is moving swiftly over rocks and water falls, even more oxygen mixes in from the air. It would be interesting to do the test in quiet waters at the headwaters of the river and again in swifter flowing water at another location.)

2. Why is dissolved oxygen important to fish and other animals that live in the water? (They must breathe oxygen, just like most other animals. Fish must have at 4-5 parts of oxygen per million parts of water, or they suffocate.)

3. Does temperature of the water affect the amount of oxygen in the water? (Yes, the colder the water, the slower the water molecules move, so the more free oxygen is able to stay in the water. As the temperature rises, water molecules move faster and bump some free oxygen atoms into the atmosphere.)

Student Experiments—Dissolved Oxygen Team

Overview: In this experiment your team will measure the amount of dissolved oxygen at your selected river location and learn what the measurement indicates about your site. Animals living in the water depend upon the dissolved oxygen to breathe. For example, fish must have 4 to 5 parts of oxygen per million parts of water or they suffocate. You will be measuring free oxygen that is dissolved in the water and available for animals to breathe. Eight to ten parts of oxygen per million parts of water is a lot of oxygen and means that the river is a healthy place for fish, mussels, and other water animals to live.

Focus: How much oxygen is dissolved in the water at your river site? Is this site a good place for fish to live in?

Materials:
Test kit or ph test tape and colorimeter
Two containers,
Water from two different sources
Pencil
Data sheet and clipboard

Procedure:
Pre-field experiment:
1. Your teacher has set up two labeled water samples from different sources in small buckets about 1/2 full.

2. The temperature group will take the temperature of each sample, record it and tell you what it is. Write them in on the chart that the teacher will provide for you on your data sheet.

3. Now follow the directions for using the dissolved oxygen kit to determine how much oxygen is in each water sample.

4. Record the amount of dissolved oxygen on your data sheet. Could a fish live in these waters? Why or why not?

Field experiment:

1. Collect a sample of water from your river location in the bucket. Fill the bucket about 2/3 full.

2. Submerge the small bottle from the CHEMette kit and fill it to the top line.

3. Put a vial containing the indicator chemical into the bottle, press down hard and break the tip of the vial.

4. Watch the water come into the vial and mix with the indicator chemical.

5. Leave the vial in for about 2 minutes and watch the color change from clear to blue.

6. When the color stops changing, place the vial into the comparator and compare colors to find the amount of oxygen in the water. Look at the number next to the color of the vial containing your sample. This is the number of oxygen atoms that are in each million molecules of water.

7. Write down the amount of oxygen on your data sheet. Oxygen is measured in parts per million (ppm).

Discussion:

1. We have much more oxygen in the atmosphere to breathe than fish have in water. We have about 21 parts per hundred and they have only a few parts per million. How can they live with so little oxygen?

2. Was the river the same temperature at each site that you measured? Were the dissolved oxygen levels the same at each site that you measured?

3. Does cold water hold more oxygen than warmer water? Why?

4. Most trout prefer to live in colder waters. What might be one reason for this? (Clue: Does your experiment help you answer this question?)

Teacher Background—Current Speed

Background: Currents in bodies of water are very important for moving food, oxygen, and microscopic plants and animals about. Currents help determine where water animals and plants live. In Betty's Meadows at the Headwaters of the Lamprey River, the river is dammed and really doesn't have much of a current. Plants with shallow root systems, such as water lilies, live there. Beavers and muskrats build their lodges there. Ducks nest near the water in grassy areas. In the river where the current is fast, plants with longer roots and flexible bodies are found. Fish swim at ease here and some build nests in gravel areas, where the current is swift and oxygen is plentiful, to deposit their eggs. Waste products are broken down and swept away by the current, redistributing them as food for filter feeders like fresh water mussels.

At this station students will calculate speed or rate of the current at two sites, dividing the distance water flows (20 meters) by the time it takes to do it. Rate = distance / time.

Preparation: Have the students mark a 20-meter rope in meters and use it both in the classroom as a measuring device for the pre-field and field experiments. They will also need several oranges to float in the river and a volleyball or basketball to use in the pre-field experiment.

Discussion:
1. How do currents affect animals?
2. What adaptations do plants have to help them live in strong currents?
3. How do you determine the rate of speed of a current? What is a current?

Student Experiments—Current Speed

Current Team: **How fast is the river flowing?**

Overview: In this experiment your team will calculate the current speed , or how fast the water in the Lamprey River is flowing. Scientists are interested in current speed because it helps to determine what kinds of plants and animals can live there. If the water is moving fast, plants must have a strong root system and leaves that let the water pass over or through them. Animals that need a lot of oxygen and can swim, burrow in the bottom or hang onto a rock prefer to live here also. If the water is moving slowly, floating plants with large leaves and a weak root system can live there easily.

Focus: What is the current speed at sites along the Lamprey River and how does it affect animals and plants there. (Try a place where the river moves slowly and one where it is moving faster.)

Materials:
Pre-field experiment:
Meter stick
Chalk or masking tape
4 balls (basketball or volleyball)
Stopwatch
Data sheet and clipboard or science journals
Pencils

Field experiment:
20-meter rope marked in meters
Stopwatch
8 items that will float (oranges, paper boats made by students, balls,
Data sheet and clipboards or science journals
Pencils

Procedure:
Pre-field experiment:
1. In the classroom or another large area such as the gym or hallway, measure a distance of meters on the floor with a meter stick. Use chalk or

masking tape to mark the beginning (A) and the end (B) of the 20 meters. Explain that the team will use the ball to represent the current of a river.

2. Have one team member start the ball rolling along an imaginary line making sure the ball is rolling as it passes A and after passing B.

3. As the ball rolls past A the team member at A should shout out "Start!"

4. A fourth team member holds a stopwatch and starts timing as the ball passes A.

5. As the ball rolls past Point B the team member at Point B shouts out "Stop."

6. The timer stops the timing and announces to the team the number of seconds the ball took to pass from A to B.

7. Team members write down the amount of time recorded in their science journals.

8. Repeat the first seven steps 4 times, rotating duties among team members.

9. Calculate the speed of the ball from Point A to Point B in centimeters per second using the following formula for each time the experiment was conducted: Current rate (Speed) = Distance divided by Time.

10. Calculate the average speed of the ball. The average speed is the sum of all recorded speeds divided by the number of times the speeds were recorded. Why did we do the experiment several times and average the results?

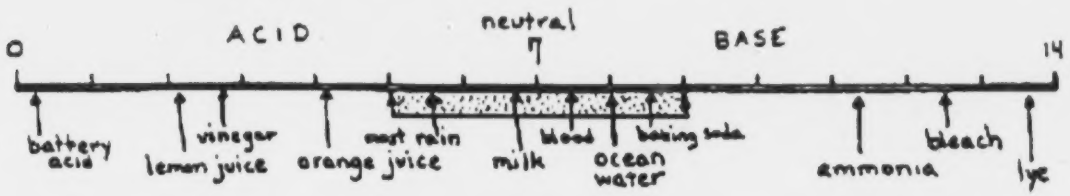
Field experiment:

1. Determine which way the river is flowing. Now designate the upstream end of the 20 meters as Point A and the downstream end as Point B. Have one team member stand along the bank at Point A and one at Point B. Follow the steps in the pre-field experiment. Repeat twice or more and average the results.

Teacher Background—pH: Acidic or Basic

Background: The pH scale runs from 0 to 14, with 7 as neutral between acidic and basic substances. Plants do well in slightly basic water (between 7 and 8 on the scale). Water animals and most plants cannot live in water that is 5 or less (very acidic) on the scale. The scale increases by powers of 10 moving from number to number.

pH Scale



At this station students will measure whether water at each location is acidic or basic (alkaline) or neutral and learn what that indicates about the water. Ordinary rainwater usually has an acidity of about 5.6. Acid rain is usually below 5.0. Sulfur dioxide and nitrogen dioxide (byproducts from burning of fossil fuels), react with water and atmospheric oxygen to produce sulfuric and nitric acid. Hundreds of lakes in North America and Scandinavia have become so acidic (below 5 on the scale) that they no longer can support fish life. In North America, 50 percent of the high mountain lakes in the Adirondacks no longer have fish because of high acidity. *(Vesilind and Pierce, Environmental Pollution and Control.)*

Preparation: Obtain a wide-ranging pH kit—one that shows all 14 levels of pH. These are available from the LaMotte Company for about $30. Some high or middle schools have these kits and will loan them to you for limited use.

Procedure:

1. Prepare four "mystery substances," each placed in its own jar. Make the jars "A", "B", "C", and "D" and make a list of what is in each jar. The substances should be rainwater, tap water with lemon juice, ammonia, and white vinegar. Each substance should be as transparent as possible.

2. Discuss what the substances might be with the students. Can they tell by looking? How else can they find out? Be sure they understand that tasting an unknown liquid is not safe. Tell the students that we have other techniques. One is to use an **indicator**—something that has been pre-tested with a variety of liquids to determine a scale of measures that we can use with unknown substances. There is an experiment in most elementary science texts showing how to boil red cabbage in water and use the water as an indicator of acids and base liquids. This will aid in understanding what an indicator is.

STUDENT EXPERIMENTS—pH TEAM

Overview: In this experiment your team will measure whether water in the river is acidic, basic (alkaline), or neutral and learn what that indicates about the water. The most common way to determine this is to measure the concentration of hydrogen ions in the water, which is the water's pH. Tthe term "pH" comes from combining the letter "p" from the German word "potenz" meaning "power" with H, the chemical symbol for hydrogen.) Changes in pH values of water are important to the health of many organisms. Fish and most plants need to live in water that is between 5 and 7 on the pH scale. Can fish live in this river? Can plants live here?

Focus: What is the pH of the water at your sites? How does the pH affect plants and animals who live there?

Materials:

Pre-field trip:

Wide-range pH kit (available from science supply stores)
Four "mystery substances" prepared by your teacher in advance, in jars labeled A, B, C, D
Science journals with A, B, C, D, listed
Pencils

Field trip:

pH kits (available form science supply stores)
One clean baby-food jar per team member
Diagram showing pH ranges that can support life
Data sheets and clipboards
Pencils

Procedures:

Pre-field experiment:

1. Look at the mystery substance A. List "A" in your science journal and what you observe about it. Does its appearance (color, thickness, etc.) help you determine what it is?

2. Open the jar. Then, holding the jar away from your face, wave your hand over the top of the jar toward your nose a few times. Sniff the air. DO NOT STICK YOU NOSE OVER THE JAR AND SNIFF DIRECTLY! Does the odor help you determine what it is?

3. Test the substance using your pH kit. Is the substance acidic or basic? Write the pH number down in your science journal next to the letter A. Does this information help you identify the substance?

4. Repeat steps 1 - 3 to test the other "mystery substances."

5. Once you have completed the testing of each substance and recorded your findings in your science journal, guess what the four substances might be. Check with your teacher to see if you are correct. Record this information next to the pH readings in your journal.

Field experiment:

1. Collect a sample of water from your chosen sites along the river.

2. Test the pH of the sample immediately after collecting it, according to the directions in your kit. (Changes of several degrees in temperature can change the reading a bit.)

3. Record the pH value on your data sheet. How does this sample's reading compare to those of the mystery samples that you tested in class? Which of the mystery sample readings is it most like? Is this a good site for fish and for plants? Why?

Discussion:

1. What was the pH of the rainwater you measured at the pre-field station and the river water at your field site?

2. Are they the same or different? Why? What could make the pH of rainwater differ from the pH of the water at your river site?

Teacher Background—Water Transparency

Background: Transparency of the water determines how far light will penetrate into the water and therefore the area where the microscopic plants that are the basis of the food chain can occur. Turbidity refers to whatever tends to cloud the water and cut off light. This can be microscopic animals and plants, eroded soil and suspended sediments and chemicals, and even physical effects such as wind riffling the surface of the water. At this station students will measure transparency and observe whether transparency of water affects two contrasting locations. Note: It may be difficult to do this test if there is much current in the location you choose. The secchi disk (sek-ki) is a round black and white disk 6 to 8 inches in diameter that is weighted and attached to a rope, market in centimeters or meters. It is lowered into the water until it disappears from sight. Then it is brought back to where it is just barely visible, and as it is withdrawn depth of the light zone is determined by counting the centimeters or meters on the rope. The students will make secchi disks in class.

Preparation: Have the items listed on the Student Experiment sheet available and build the secchi disks as a class or team activity.

Discussion questions:

1. Why is transparency of the water important to plants and animals?

2. What might be in the water that cuts down on transparency?

Student Experiments—Transparency Testing Team

Overview: In this experiment your team will measure the transparency of the water at your river sites. The clearer the appearance of the water the more transparent it is, and the more light is available for water plants to use to make food. Many small animals eat these microscopic plants called phytoplankton, and are then eaten themselves, by larger animals. Phytoplankton is the basis of a food chain that often includes us. Many things can cut down on transparency and make the water **turbid**. Can you think of some? You will use a Secchi disk to measure transparency. A Secchi disk is a scientific tool for measuring relative clarity of deep water.

Focus: How far does light penetrate into the water at your chosen site?

Materials:

Pre-field experiment:

Large plastic can lid, white or light-colored, 20 centimeters (about 8 inches) in diameter
One black waterproof marker
10 meters of 1/4" rope (a thin clothesline rope)
A 2# fishing weight
Strips of colored ribbon
Eyebolt with 2 nuts and washers
Several sharpened pencils
Data sheet and clipboards or science journals
Pencils
Meter stick
Ruler (marked with centimeters)

For the field experiment:

Secchi disk (constructed from the materials above)
Data sheet and clipboards or science journals
Pencils

Procedures:

Pre-field experiment

Before you can measure the transparency of the water at your river location, you need to construct a Secchi disk. (If the disk has already been constructed you should go to step 6 and read how the Secchi disk will be used.)

1. Use your ruler to find the center of the plastic lid. Measure across the lid until you find the widest point from one side to another. Draw a line. Then turn the lid so that the line is straight up and down. Draw a line across the widest point again. Now your lid is divided into quarters.

2. Use the waterproof marker to divide the top (outside) of the lid into quarters. Color the upper left and lower right sections black.

3. Use a sharpened pencil or a ballpoint pen to punch a hole in the middle of the lid.

4. Thread a nut and washer (in that order) onto the eyebolt.

5. With the nut and washer on the eyebolt, insert the eyebolt through the center of the lid. Then add the other washer and nut (in that order) to the eyebolt on the underside of the lid.

6. Use duct tape to attach the fishing weight to the bottom of the lid so that the lid will hang straight, horizontally. (This takes some trial and error experimenting.)

7. Tie one end of the rope to the eye of the eyebolt.

8. Using the meter stick, measure from the eyebolt 250 centimeters (about 10 inches) along the line, and tightly tie a ribbon around the line. Continue tying ribbons to the line every 250 centimeters. In the field, you'll lower the Secchi disk into the water. As soon as you con no longer see it, you'll stop and calculate the number of ribbons submerged to determine the transparency of the water.

Field Experiment:

1. If possible, stand on a bridge over the water at your River location. If there is no bridge, simply use the bank. Lower the Secchi disk into the water just to the point where you can no longer see it.

2. When you can no longer see the Secchi disk count the number of ribbons remaining above the surface of the water. Subtract the number from the total number of ribbons on the line to calculate the number of ribbons submerged with the disk. This is the distance light travels through the water and provides your transparency reading.

EXAMPLE: Suppose you count 10 ribbons above the water at the time you can no longer see your Secchi disk. If your rope had a total of 15 ribbons, you would subtract 10 from 15, and your turbidity reading would be 5. If your Secchi disk reaches the bottom and you can still see it, you should still record the number of ribbons submerged with the disk. If you can still see the disk after it has reached the bottom, what do you think it means?

3. Repeat the procedure once or twice at different sites along your location recording the transparency each time. To get an average of your readings, add the transparency readings and divide by the number of times you performed the test. Record the average turbidity reading in your science journal.

Discussion:

1. What do your transparency readings tell you about the water at your site?

2. How does light affect life in the water?

Data Sheet #1: What is the river like at this location?

Site _____

Your name _____ Date _____

Describe the following:

Movement of the river _____

Width of the river _____

Color of the water _____

Sounds the river makes _____

Smells you notice _____

Is the river deep or shallow? _____

How the river bed looks ___sandy ___muddy ___rocky ___other

(If you checked "other," explain:) _____

Landforms surrounding the water: ___mountains ___ hills
___flatland ___marshland ___forest ___fields
___other? _____

Man-made structures _____

Comments _____

_____

Data Sheet #2: What changes can you find at this location?

Site _____

Your name_____ Date _____

Describe the following:

The animal life you see in the water _____

_____

The animal life you see near the water _____

Things that have been changed by weather (floods or ice), animals (beavers, muskrats, mice, woodpeckers), or man (fire, trails, gardens, trees planted or cut)

weather _____

animals _____

people _____

signs of pollution _____

_____

Comments _____

Your group may collect a sample of leaves, rocks, and soil from each stop on the field trip. Take only one of each item sampled and use one bag for each site. Use the plastic jar to take a water sample for viewing later with microscopes. Remember to label the bag and jar with your name, date, and the site.

Data Sheet #3: Draw this site in the space below.

Site _____

Your name_____ Date _____

Data Sheet #4: What animals live at this site?

Site _____

Your name _____ **Date** _____

What animals can you hear? _____

What animals can you see? _____

Be a detective! Find signs that prove animals live here. Describe where you found each one. Look for:

Nests _____

Webs _____

Cocoons _____

Burrows _____

Tree holes _____

Other marks on trees _____

Trees cut by beavers _____

Droppings _____

Tracks (what kind?) _____

Other _____

What animals probably live here? _____

_____

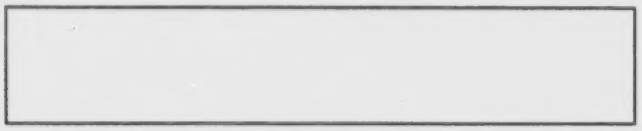
Data Sheet #5: What trees can you find here?

Site _____

Your name_____ Date _____

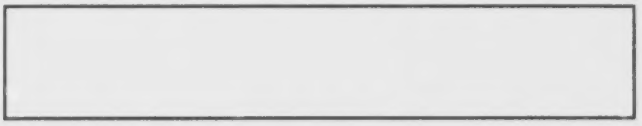
Go to the wooded area and stay there to observe the different kinds of trees. Use a tree guidebook or adult to help you. List three trees that you can identify, draw the pattern of their bark and make a sketch of each tree.

1. _____



2. _____

3. _____



What kind of tree is the most common here? _____

Are the trees different heights? _____ Why or why not? _____

_____

Has anything damaged trees that grow here? What? How can you tell?

_____

Collect one of each different kind of leaf from the ground. Put the samples from one site in a ziploc bag and label with your name, date and site.

Data Sheet #6: What are some of the small plants at this site?

Site _____

Your name _____ **Date** _____

Choose a sunny spot and a shady area, and spend time there looking at some small plants that grow there. Use the wildflower and pod guides to help you identify them. Choose your favorite plant from each location and sketch it. Remember to write in the color and whether it has an odor.

1. Plant growing in the sun

2. Plant growing in the shade

How are the plants different? _____

How are they alike? _____

Which one is bigger? _____

What kind of soil are they growing in? Sunny plant _____

Shady plant _____

Your group may collect the plant if there are at least 20 of the same kind in the area. You may collect pod samples or seed samples if there are any. Store them in a small ziploc bag with your name, date and site.

Data Sheet #7: What fungi can you find at this site?

Site _____

Your name_____ Date _____

Go to a damp shady site and look for fungi. Fungi can also grow on the trunks of trees. Try to find as many different types of fungi as you can. Describe at least one and draw a picture of it. Don't forget to write down its color.

Data Sheet #8: What were the results of your experiments?

Site _____

Your name_____ Date _____

List data from your experiment here. Collect data from the other groups and fill in the rest of your data sheet.

1. TEMPERATURE TEAM. List air and water temperatures in Fahrenheit and Celsius.

	Fahrenheit	Celsius
Air		
Water		

2. DISSOLVED OXYGEN TEAM. Remember the colder the water is, the more free oxygen it holds.

Dissolved oxygen is _____parts per million (ppm)

3. pH TEAM. Is the Lamprey acidic or basic? _____

The pH reading at this site was _____

4. CURRENT TEAM. Remember that the distance and the time it takes your floating object to travel can help you find the rate or speed at which the current is moving. Distance divided by time equals the speed of the current. Your distance is 20 meters which is the length of the rope.

Distance	Time	Current meters/sec.

The average speed of the current at this site is_____

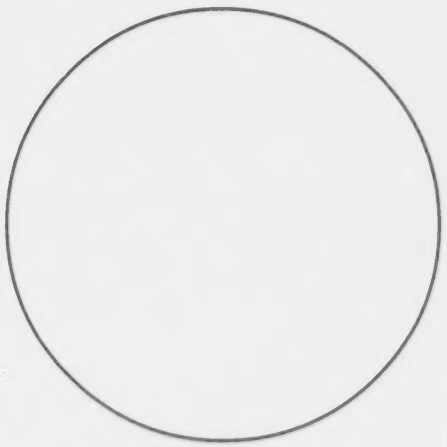
5. WATER TRANSPARENCY TEAM.

Light can penetrate _____ centimeters into the water at this site.

Data Sheet #9 What can you see in your water sample?

Site _____

Your name_____ Date _____



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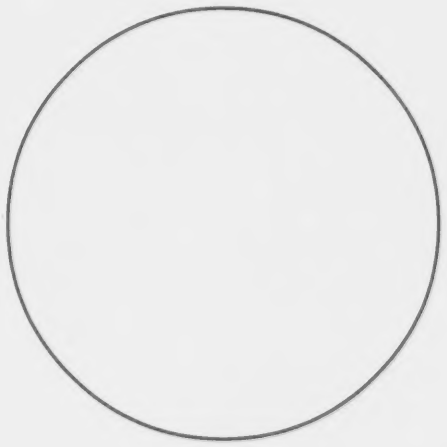

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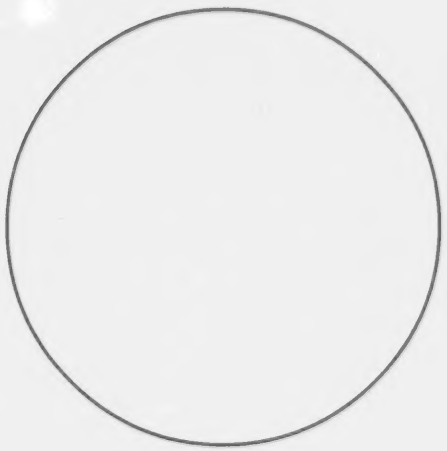

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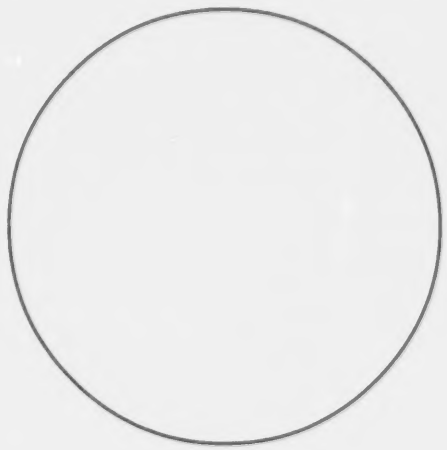

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People of the River

Overview: In this lesson your students will learn about the people who have lived along the Lamprey River in the past. They may have lived at any time between 1600 and the mid-1900's. There are more than 20 profiles of these people from Lamprey River communities following this lesson. Their stories give us a glimpse of life along the river during another time.

Focus: Who lived along the Lamprey, and how did the Lamprey influence their lives?

Duration: several hours

Materials:
____Multiple copies of "People of the River" profiles at the end of this lesson
____Other resources about New Hampshire history
____Street maps of communities along the river
____Poster board, construction paper, markers, glue, paint, brushes (whatever the students need for their projects)

Procedure:
1. Find out what your students already know about the people who have lived along the river. Encourage the children to ask their parents and grandparents about people from their families who may have lived near the river in the past. Look at street maps of communities along the river. How many streets are named after people. What are those names? When did they live? What were their occupations? How did they use the river?

2. Encourage the children to read several of the profiles. Have each student select his or her favorite. Ask them to read it, think about the information, and then tell a partner about the article.

3. Have the student take notes from the article. Ask them to think about the following questions. What are the important facts about this person? When and where did the person live? What do you think the person looked like? What did he or she do for work? What is special and fascinating about this person's story? They may use the "People of the River" note-taking guide or record their information in their journals.

4. Now your students should plan their posters, or similar projects. Questions for them to ask themselves are: What should the title be? What information should be on the poster? Do I need other resources? Do I need maps? Where can I get more information?

5. After they have gathered their information, brainstorm with your students about how to make their poster attractive. Written information should be clear and neat. Have them gather pictures, make photocopies, or draw pictures for their poster. They may type written information they plan to include in their poster.

6. Help the students decide when they are ready to create their posters or projects and give them time to complete them.

7. After the posters are completed, students should work on their class presentations. They may work alone or with a partner. A short role-playing session illustrating good presentation skills would be helpful. In discussion with the class, draw up a list of criteria for good presentations. Use this as a guide and an evaluation tool when the presentations are given.

8. After the students give a presentation, the other members of the class might write a few sentences or make a small drawing about the person being described in their journals.

9. Encourage your students to find ways to connect the information from the articles to the large map created in Lesson 3.

Other ways your class might use the profiles:

1. Create a time line, then add names, dates, and pictures generated from the information in the articles.

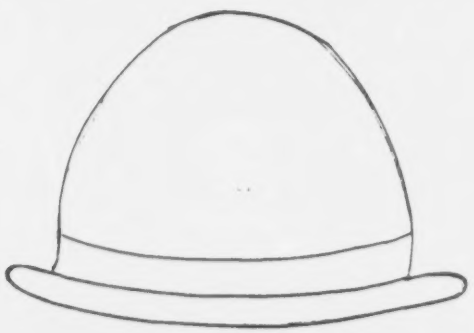
2. Dress up as "river people," and then give oral presentations or create a play.

3. Gather or make props that relate to the information in the articles, then give oral reports that incorporate the props.

4. Make advertisements for or about the people in the articles.

5. Draw profiles of human heads. Make hats that might have been worn by the river people. Attach cards that give interesting information about the person to the profiles.

6. Write ads for workers in the various jobs represented by the People of the River profiles. Publish a classified section of a newspaper, using the ads, or design them as posters.



"People of the River" Note-taking Guide

What was the person's name? _____

When did the person live? _____

Where did the person live? _____

What did the person do for work? _____

_____

How was the person connected to the river _____

_____

What were some interesting facts about the person? _____

_____

_____

What other information did you learn about the person? _____

_____

_____

Imagine how the person looked and write a short description. _____

_____

_____

_____

Matt H.

Shelby C.

NATIVE AMERICANS—PEOPLE OF THE DAWN

Archeologists have studied several sites on the Lamprey River. They found tools, arrowheads, pieces of pottery and bones. When they tested these **artifacts**, the results proved that Native Americans lived along the Lamprey River 8000 to 9000 years ago and continued to live there until the 1700s. The Native Americans in the area were probably part of the Piscataqua or Squamscot tribes. They called themselves the Abenaki or People of the Dawn and belonged to the larger Algonquin group.

These native people set up their summer camps at spots that were convenient for fishing, farming, or finding materials for clothing, shelter or food. One site might be near clay banks of the river where they could use the clay to make simple dishes. Another campsite might be near a stone quarry where they could get stone to make tools and arrowheads. A third site could be near the marsh grasses whose seeds they gathered for food. Or they might camp on the shores of Great Bay where they could harvest oysters and clams. We know they lived and fished on an island in the river at Wadleigh Falls in Lee.

The "people of the dawn" continued to live near the river after the European settlers began arriving in 1623. They were peaceful and traded furs for cloth, blankets, pots and knives. The settlers learned many valuable things from the Abenaki people, such as what plants could be used as medicines, and how to make snow shoes.

Wadononamin, **sagamore** or chief of the Piscataqua tribes, granted the land between two branches of the Lamprey River to Edward Hilton, Jr., on January 17, 1660. Edward Hilton, Jr., was the oldest son of Edward Hilton, one of the first settlers of Dover. The native people called this place Washucke. It was agreed that Wadononamin could use the Washucke planting ground during his lifetime.

Many Native Americans left the area in 1672 and moved to the Hudson River near Troy, New York. This happened before King Philip's War in 1675, the first of the great New England Indian Wars. Do you think they knew there was going to be a war? Is that why they moved? What might have been other reasons?

Picture of Indian spearing fish

THE FREESE FAMILY

Deerfield

In the early 1700's, Jacob Freese, a resident of Epping, bought 150 acres of land in what was to become the town of Deerfield in 1763. At the time, Deerfield was known as **Range** 5. He added 40 more acres in 1768. The Lamprey River flows across this property near where Deerfield Elementary School is now.

Jacob never lived on this land, but he and his sons developed the mill site on the river. A dam, which is still standing, was built and created Freese's Pond. In 1773, Jacob's son Andrew made his home near the millpond. By 1780, the family had built a house, barn, and other smaller buildings on their property. They also owned half interest in the sawmill and **gristmill** (for grinding grain into flour) near the dam.

Farmers did many different kinds of work during the year. Andrew Freese cut and hauled logs to the millpond during the winter. Sleds pulled by horses carried the logs across the snow. When the millpond thawed in the spring and flowing water once again turned the mill wheels, the logs were sawed into lumber. The farmers then hauled their lumber by horse and wagon to their homes, where they used it to improve or repair their farms. They might also sell the lumber in order to buy supplies. During the spring and summer the farmers worked on their farms, raising crops and tending their animals. In the fall, the grain they harvested from their fields was hauled to the gristmill where it was ground into flour. Soon it would be winter and they would be cutting timber once again.

Andrew's sons, Dudley and Jacob, continued to live on the farm and run the mill. Jacob built a second home on the property. This land stayed in the family for nearly 200 years, but by 1904 the mill wheels were no longer turning, and the old mill was falling down. The Freese and Robinson families continued to maintain the dam. The original home site was sold in 1928. The rest of the property, the pond and the dam were sold in 1970.

Lone Tree Boy Scout Camp

Deerfield

For 8,000 years, people have camped along the river; first the Native Americans, then colonists, and finally scouts and other recreational groups. Have you ever camped along the Lamprey?

The Lone Tree Boy Scout Council of Amesbury, Massachusetts, wanted to build a summer camp for their scouts. Their search led them to Deerfield, New Hampshire. There they found a good site for a camp on Freese's Pond. Freese's Pond was really a millpond, which was created when a dam was built across the Lamprey River. This property was owned by Jenny Freese. In 1928 the council bought 150 acres from Jenny and began transforming the Freese farm into a summer camp for boys.

The Council created a waterfront by adding docks, floats and a diving board. They were given permission to **dredge** the pond or add height to the dam in order to make the water deep enough for diving. Soon they had a swimming and boating area for the scouts to enjoy.

Most of the Freese farm buildings were turned into camp buildings. The house became a store and post office. Then the barn, with the addition of a wood floor, screens and kitchen, became the **mess hall**. It could serve 100 boys. A large stone fireplace was built at one end of the barn. The carriage house became the craft workshop and the shoemaker's shop became the camp's **infirmary**. Across the road, volunteers built cabins and tent platforms where the boys would sleep.

The camp was dedicated in 1929 and was still operating in 1937. By 1943 the property had been sold and the camp was no more. Some think the camp was sold for fear of polio being spread by swimming in fresh water.

VALENTINE HILL

Durham

Valentine Hill was one of the early settlers of Durham. He was from England and had a brother who lived in London. By 1636 he had sailed to America and was living in Boston where he was a **proprietor**, the deacon of a church, a member of the Ancient and Honorable Artillery Company, and part owner of a wharf.

In 1643 Valentine received a **grant** of land on the Oyster River. His second land grant was at Wheelwright Pond. He raised cattle on this property. Both of these grants were in the town of Dover, because Lee and Durham weren't towns yet.

In 1649, Valentine and William Beard got permission to build the first sawmill at the falls on Oyster River. At that time mills used flowing water to turn water wheels. The water wheel turned gears that moved the saw up and down. When a log was pushed toward the saw, the saw blade moving up and down cut it into flat boards.

Valentine built a house near his mill, then received another 500 acres for a farm on the north side of the Oyster River. This property included all the land that eventually became the village of Durham.

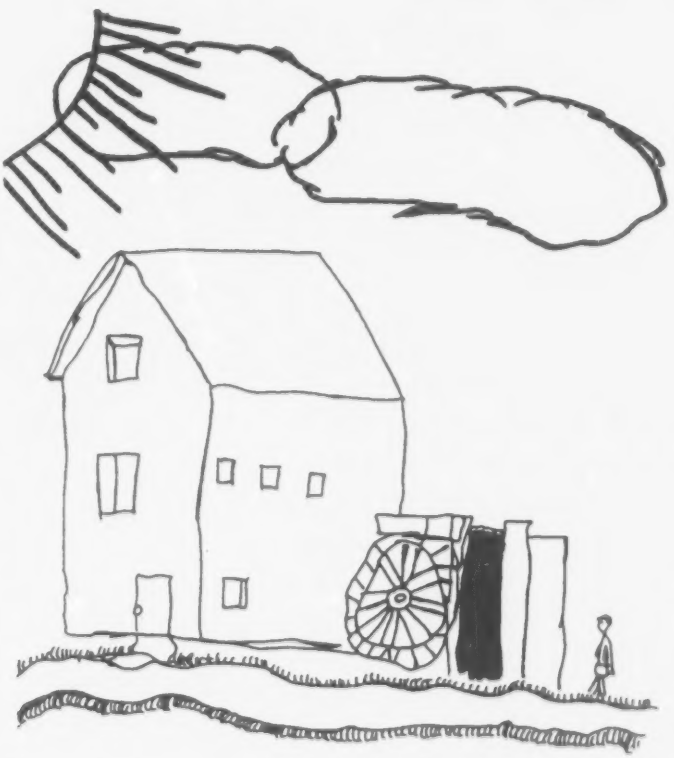
In 1652, he was given permission to build mills on the Lamprey River, too. He was also allowed to cut the timber along the river. His **timber rights** extended a mile into the woods.

Valentine's mill on the Oyster River often couldn't operate in the summer and fall because there wasn't enough water flowing over the falls to turn the wheel. Of course, it all depended on the amount of rainfall the area had received. He looked for ways to increase his waterpower and decided to build a canal from the Lamprey River to his mill. This would direct some of the water from the Lamprey River into the Oyster River. When he got permission to build the canal in 1655, it was probably the first canal project in New England.

Valentine's canal was to begin at the Moat, an island in the Lamprey River that is near Packer's Falls, connect with Denbow's Brook, and flow into the Mill Pond above Oyster River Falls. Longmarsh Brook could be this canal. However, no one is sure if Valentine ever completed the canal.

Valentine employed many men at his farms and mills. Some of them were Scots who were taken prisoner by the British. The prisoners were marched to Durham and Newcastle in England and many were shipped to Boston on the ships Unity, John and Sara. In Boston they were sold for 20 pounds each. They had to work from 5 to 7 years to pay for their passage and to learn a trade. At the end of that time, they were **freemen**. They couldn't marry until they were free. These men worked in shifts at Valentine's mills and had three days a week to work in their own gardens. Patrick Jameson and Thomas Doughty were both Scots who were **indentured** to Valentine Hill.

In 1655 Valentine built the first **meetinghouse** in Durham. He was selectman from 1651 to 1657 and a judge from 1652 till his death in 1661. His first wife was Frances Freestone who died in 1644. His second wife was Mary Eaton.



Cailin B.

Moharimet was a Native American chief or **sagamore** of this region in the seventeenth century. Many old records, such as wills and deeds, mention Moharimet's "planting ground," Moharimet's Marsh, and Moharimet's Hill as landmarks when describing the location of land. For instance, in 1656 Charles Adams had a **grant** of 100 acres of land at the foot of Moharimet's Hill. The name "Moharimet" is still used today and is the name of an elementary school in the Oyster River school district.

Moharimet's "planting ground" where his people planted squash, beans and corn was along the Lamprey River in Durham. Moharimet's Marsh was near the "planting ground." Moharimet's Hill was in Madbury. According to legend, Moharimet lived on this hill. It is also said there is a "Council Rock," a large boulder where he made peace with the settlers. It was the meeting place of his tribes.

Moharimet was present when Samuel Symonds of Ipswich, Massachusetts bay colony, received a land grant from the King of England of 640 acres and water power rights on the Lamprey River. His **water power rights** were at Wadleigh Falls in Lee, which at that time was part of Dover.

What do you think Moharimet was like? Do you think he realized he was agreeing to his land being owned by someone else? Did Native Americans think that anyone could own the land?

INA THOMPSON — Durham

The following information is from a paper written by Ina Thompson called "The Lamprey River." Excerpts from this article appeared in The Transcript on August 1, 1978. The title was "Lamprey River: A Place For Fun." It's about Ina's memories of the Lamprey River and life at Highland House. Highland House was an inn operated by the Thompson family. It still stands on Bennett Road in Durham.

Part 1: Ice Houses

Highland House had its own ice house. Neighbors got together in February to cut ice from the river. After the snow was shoveled off the river, someone used an ice saw to cut the ice. Cutting the first piece was the hardest part. You used sturdy tongs to move the ice, but you had to be careful not to fall in.

According to Ina Thompson, "A team of horses fell in one time, and another team pulled them out. My dog fell in and was gotten out by the men, then raced to the house to be rubbed down and dried by the kitchen range."

After several pieces of ice were cut, they were hauled to the ice house on a sled. The blocks of ice were arranged in the ice house, then sawdust was placed between each layer. This process continued until the ice house was full. It worked so well that the ice didn't melt for a whole year.

Mr. Fillion of Newmarket filled his ice house, which was at the river's edge, each winter. Then in the summer the ice was taken by horse and wagon and sold to homes and businesses in the area. The crystal clear ice cakes were used in refrigerators or ice boxes. "Highland House has a walk-in ice refrigerator used in the olden days for sides of beef, lamb, pork and veal," said Ina Thompson.

Turcotte's Hardware store in Newmarket had an ice house in the back. The Star Theater was above the store. It seemed that air was cooled as it passed through the ice house, then blew into the theater,

creating the "first cooling system in Newmarket."

Highland House and the Griffiths Brothers were the first buildings to have electric lights in Durham. Newmarket Electric Light Heat and Power Company built an electric power station at Wiswall Dam in 1899, so, by 1900, Durham homes and businesses began to have electricity. When people got electricity and bought electric refrigerators, ice houses became "a thing of the past."

Shelby C.

Bradley W.

INA THOMPSON — Durham

The following information is from a paper written by Ina Thompson called "The Lamprey River." Excerpts from this article appeared in The Transcript on August 1, 1978. The title was "Lamprey River: A Place For Fun." It's about Ina's memories of the Lamprey River and life at Highland House. Highland House was an inn operated by the Thompson family. Elmer and Amanda Thompson moved to Durham from Williamsburg, Virginia in 1919 with their two daughters, Ethel and Ina. They transformed the property into a summer resort where people boated, fished, swam, and enjoyed the Thompson's wonderful home cooking. When Ina was in her seventies, she donated the property to UNH. Highland House still stands on Bennett Road in Durham.

Part 2: Other Memories of the River

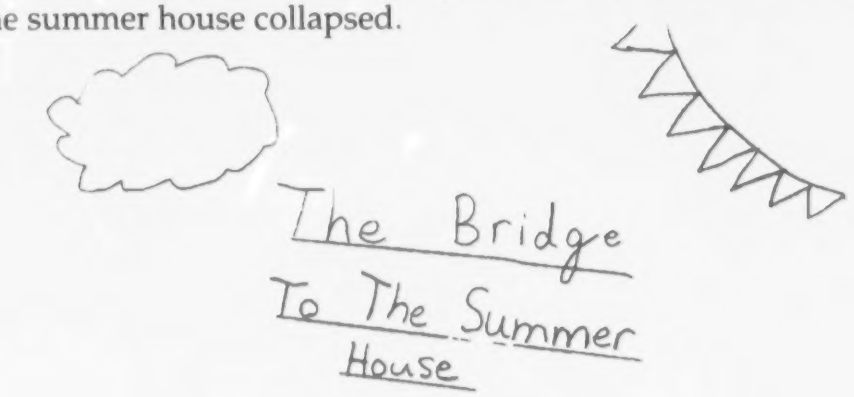
"In the 58 years I have lived here, skating was not safe until December.....When snow came, skating ended, but ice fishing took its place." When spring cam, the ice went out. "Bets were made (on the exact date when ice-out" would happen). Huge ice cakes coming from upstream would zigzag their way through the **rapids**, end over end and finally stop up against the river ice." Once the river ice was freed from the banks, it broke up and flowed to the sea. "Usually it went out in the night, and the next morning the river was once more blue and sparkling."

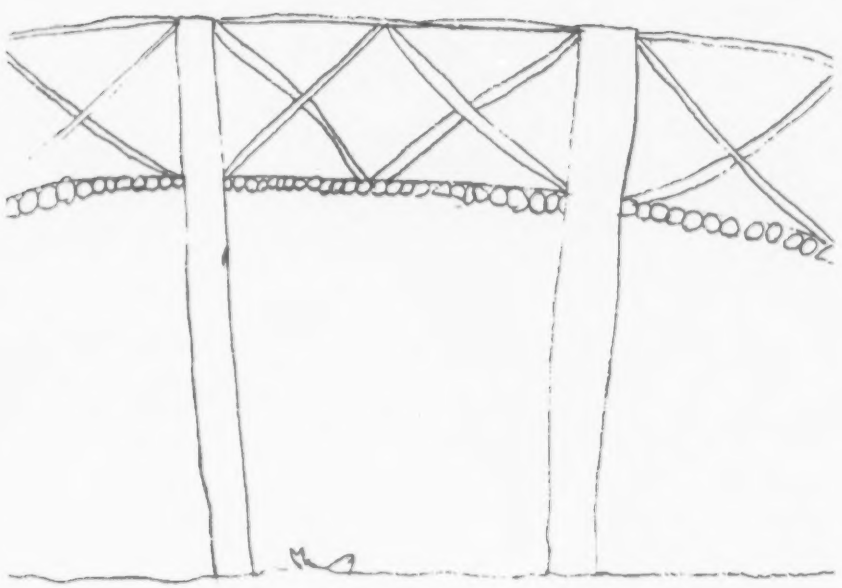
With the ice out, boats were painted and taken to the **landing**. Highland House had two white and blue row boats which often made the two mile trip to Newmarket. After tying the boat at the bridge in town, you could visit Al Place's Drug Store, Griffin's Hardware Store, Priest's men's clothing store, Mrs. Garneau's ladies shop, the La France or La Branch meat shops, a barber shop, a bank, or the post office.

"Many guests from all over the world stayed at Highland House and enjoyed the Lamprey. The children loved to fish. One day one of the young boys came home with a gunny sack filled with eels. He went to bed that night and shut the bag of eels in his closet. The next morning the eels were all over his room....The Highland House,

years ago, set out eel pots and came up with a good catch. They were considered a delicacy."

In 1932 Elizabeth Thompson, with the aid of the Dow Nurseries of Epping, built a summer house on the rock island in front of the hotel with an arched bridge connecting the shore to the island. It was a thing of beauty. People came from New York to sketch it. A sandy beach on one side was for swimming. A 1000 watt light was installed for night swimming. In 1938 a spring with heavy rain raised the river and the summer house collapsed.





Shelby C.

THOMAS H. WISWALL

Durham

Thomas H. Wiswall was the son of Thomas and Sarah Wiswall of Exeter. He was born in 1817 and went to school in Exeter. When Thomas was only 16 years old, he began working in his father's paper mills. His goal was to learn everything there was to know about the manufacturing of paper. In 1846, he took charge of a paper mill in Dover. After 3 years in Dover, he worked for another paper mill in Exeter.

In 1853 Thomas and Isaac Flagg leased a dam, mill building, and **water rights** on the Lamprey River from Moses Wiggin. The rent was $350 a year. In the lease Moses Wiggin agreed to dig a canal and build a two- story mill building equipped with two water wheels. In 1854, Wiggin dug the canal and moved a machine shop from Newmarket to the third falls on the river which are now called Wiswall Falls. Wiswall and Flagg converted the machine shop into a paper mill with modern machinery that produced wallpaper. The canal increased the water power capabilities of the site. Water wheels were built that turned the gears to operate the machinery.

The Flaggs sold their share in the business to Howard Moses. When Howard died, his father, C.C.P. Moses, took over his son's share in the partnership. At this time the company's name became T.H. Wiswall and Company.

When Moses Wiggin died, Thomas Wiswall and Joshua Parker bought all the mills at the site for $4,900. Wiswall got the paper mill and Parker got the grist and flour mill and the sawmill. Parker's mills had four water wheels. All of these buildings were two stories high.

In 1858 Thomas Wiswall bought Parker's share of the property and water privileges for $3,300. Thomas also bought out C.C.P. Moses share of the business for $1,650. Since it was nearly impossible to run all the water wheels during the dry seasons, it was better for business if one person owned all the water rights.

By 1860 the sawmill was producing only half as much lumber as it had when Wiggin operated it. The grist mill had one employee who ground 2,000 bushels of cornmeal per year. That amount of cornmeal had a value of only $2,400. But, the paper mill was making money. It employed 8 people and produced 200,000 yards of paper a year. That amount of wallpaper was valued at $30,000. The wallpaper was transported by wagon to the train depot and shipped to Boston to be sold. T. H. Wiswall was the largest industry in Durham.

Eventually, the unused mills became run down and the operation of the grist and flour mill was discontinued. The paper mill, however, continued to be **very profitable**. The main building was enlarged and two buildings were added, a bleach house and a **stock** house.

In 1868, the dam was rebuilt and houses were constructed for the mill workers. A store was operated by Austin Doeg. There were four houses on the north side of Wiswall Road. Three are still standing. The sawmill was at the edge of the mill pond and the paper mill was on the island formed by the canal. An office was located near the canal. This was the busiest spot in Durham.

By 1870 the sawmill was only producing 90,000 feet of boards worth $1,620, but the paper mill had doubled its output. The 12 people working there produced 309 tons of wallpaper valued at $69,365. The mill also had a steam engine powered by burning wood or coal.

By 1880, there were 15 workers, and 309 tons of paper were still being produced, but the value had dropped to $45,000. Wages varied depending on the job, and ranged anywhere from $.90 to $1.10 for an 11-hour day.

On November 1, 1883, the paper mill and most of the other buildings at Wiswall Dam were destroyed by fire. Two women were burned in the fire. Mr. Wiswall retired from the business, so the mill

buildings were never replaced. He was unable to sell the property. He maintained the dam and ran the sawmill until 1896 when part of the dam was washed away by the spring floods.

In 1899, Mr. Wiswall sold the land and mill privileges to James Burnham, President of the Newmarket Electric Light Heat and Power Company. Burnham built a small **hydroelectric** station where the paper mill had been. On February 20, 1900, the first electrical power in Durham was supplied to Highland House and the homes of James Burnham and the Griffiths brothers.

Bradley W.

HEDDING CAMP MEETING ASSOCIATION — Epping

Religious camp meetings were held in South Newmarket from 1857 to 1862. In 1862, a committee was formed to buy land and create a permanent camp location. Reverend Calvin Holman, agent for the committee, bought land from Ezra and Daniel Barber of East Epping. The Lamprey River crosses the northern edge of this property and provides the camp with access for swimming and boating activities.

The organization was incorporated as Hedding Camp Meeting Association in honor of Bishop Hedding. The Association consisted of pastors in the New Hampshire Conference and owners of the cottages within Camp Hedding. Some of the land was cleared and the first meeting was held there in 1863.

At first the meetings were held in a grove of trees, where a large circle of seats was constructed. Families came to relax, listen to the sometimes fiery preachers, and enjoy camping in tents. Because many people attended these meetings, the Concord & Portsmouth Railroad constructed a track from the East Epping station right into the campgrounds. In 1887 **Chautauqua** Hall was built where meetings, summer school, and lectures were held. Eventually, many cabins were built on the grounds, along with a library, bakery, recreation hall, and community hall. In 1891 a fire destroyed 10 cabins, so a water system was installed in 1892.

The name of the East Epping post office and railroad station was changed to Hedding in 1896. In 1902, electricity was supplied to the buildings within the camp grounds. The following year the camp sold spring water. In 1916 Camp Hedding for Boys was established, followed by Camp Hedding for Girls in 1918. During the Great Hurricane of 1938, 1000 of the largest pine trees on the grounds were blown down.

Hundreds of people still spend their summers at Hedding and religious meetings continue to be held on the grounds.

Dr. Isaiah D. Edgerly

Lee

Dr. Isaiah D. Edgerly (1800-1870) came to Lee from Strafford, New Hampshire. He moved here after the Civil War. He bought a large farm, general store, and mill at Wadleigh Falls on the Lamprey River in South Lee.

He converted part of the mill into a medicine mill. People from the neighborhood, including children who attended the school at Wadleigh Falls, collected herbs, roots, and bark for his mill. The children particularly liked to gather slippery elm bark because they chewed it like gum. The ingredients for the medicines were ground and mixed by eight water- powered **mortar and pestles**. The medicines were bottled at the mill. The brand name for the medicine was "Dr. I. D. Edgerly & Son." One of the bottles is in the Lee Historical Society's collection. Around 1875 the family's large two-story mill burned, but they rebuilt the medicine and **grist mill**, also adding a cider mill.

Dr. Edgerly's medicine was probably shipped by stagecoach to Newmarket, Northwood, or Durham. The stage coach stopped at Wadleigh Falls. Later, after the trains came to town in 1874, the medicine would have been hauled by wagon to the depot in South Lee, and shipped from there.

Dr. Edgerly's son, Isaiah, was married to Susan Hill. He was a Lee selectman for three years. In 1879 his daughter, Annie Josephine, who was 12 years old, went to pick pond lilies at the mill pond. The water in the pond was quite deep, held back by the big dam at Wadleigh Falls. Annie fell into the pond and drowned. Her brothers attempted to rescue her, but were too late.

Isaiah died in 1902. The mill and store are gone, but his large three story home still stands at the falls, at the intersection of Route 152 and Campground Road.

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Captain Reuben Hill

Lee

Around 1750, Reuben Hill and his wife, Abigail, owned farm land and mills on the Lamprey River. His mills were above a bend in the river that we call "Lee Hook." In 1750, the town of Lee didn't exist, so Reuben's property was in the town of Durham. Reuben's mills were located near waterfalls that came to be known as Hill's Falls by the local people. His mills, a sawmill and **grist mill**, were powered by water from the Lamprey River. Do you know what a grist mill is? It's a mill that grinds grain, such as wheat, into flour.

By 1760, Reuben had built a house on a hill just south of the river. The house still stands on Lee Hook Road. His mills were on the other side of the river. Reuben also built a stone bridge across the Lamprey. There's still a bridge there on Lee Hook Road, although the stone bridge no longer exists. Do you think he built the bridge so he could get to his mills more easily? He actually charged a toll for the use of his bridge and in 1771 was paid five pounds, one shilling by the town of Lee. His bridge was known as "Hill's Bridge."

Reuben was one of 100 men who signed a letter requesting that his village be allowed to separate from the town of Durham. This letter or **petition** was written on November 18, 1765, signed, then sent to Governor Benning Wentworth and the **General Assembly** in Portsmouth. A vote was taken, the governor selected a name, and Lee became a separate town on January 16, 1766. Reuben served as a selectman for the town of Lee before he died in 1794.

Reuben also supported the fight for American Independence. First, he signed the **Association Test** promising to oppose the British armies. The Association Test was a paper that was sent to all the towns in New Hampshire by the Committee of Safety to find out how many people were **Tories**, loyal to the King of England, and how many were **Patriots**, loyal to America. Later he became a soldier and fought in the Revolutionary War.

Leah B.

84

ADIN AND SAMUEL JOY

Newmarket

Adin and Samuel Joy were inventors. They were the sons of Samuel and Susan Davis Joy who lived near Rockingham Junction in the southern part of Newmarket. Adin was born in 1859 and died in 1940. Samuel was born in 1861 and died in 1941. Adin lived on Ash Swamp Road and Samuel lived on the family homestead. Sam invented many gadgets. One was an oven pie lifter used to remove hot pies from the oven. This invention has a wooden handle which is attached to two metal loops. The loops are shaped like rounded triangles. You reach into the oven and attach the loops to the sides of the pie pan, then lift the hot pie out of the oven. It's amazing!

His most successful invention was the Joy Wagon Jack. It was used to hold up a wagon bed so that the wheel could be repaired. It was made of wood and metal. The part that held up the wagon looked like a set of stairs. This made it so the wagon jack could be used on different kinds of wagons, or wagons of different heights. For taller wagons, the jack was positioned under the wagon using one of the taller steps. Then, by cranking the lever, the wagon box was raised so that the wheel could be fixed.

Adin invented an adjustable wrench that could tighten or loosen wagon wheel nuts. The wrench was made of metal and had "Rockingham, N.H." cast in it. Examples of all three of these inventions can be seen at the Newmarket Historical Society.

The brothers made and sold their inventions right in Newmarket. Sam had a shop on Ash Swamp Road. His work benches were attached to a train track in the floor of the shop, so they could be moved around easily. A belt was attached to the bench's machinery, so it could be powered by **horse power**, **water power**, or later, electricity.

Jon B.

James Hill

Newmarket

James Hill was a landowner, lumberman, and shipbuilder. James kept a diary that tells about his life and work. He built boats for a military expedition in New York in 1755, when the English were trying to defend their colonists against attack by the French and Indians. The boats were used in battles on the Hudson River and Lake George. He also helped to build the warship Achilles in 1758 before moving with his wife, Sarah Coffin, to Newmarket in 1761. He began building ships on the river soon after he arrived. Five months later he launched a **brig** for William Whipple of Portsmouth. (A brig is a sailing ship with two masts.) James also helped to build the ship America. (See the profile on shipbuilding.)

James also served in the Revolutionary War. He was made Lieutenant Colonel of the 4th Regiment of Militia in New Hampshire. He was promoted to General of the State Militia, and was known as General Hill. He also served in the Third Provincial Congress in 1775, and was appointed to the New Hampshire General Court for several terms after that.

At first James and Sarah lived on Newmarket Neck. Sarah died in 1774, and James married Sarah Hoyt. They moved to the Moody Parsonage in Newmarket in 1784, where James lived till his death in 1811.

AMBROSE J. NICHOLS

Newmarket

Ambrose J. Nichols was one of the managers of the Newmarket Manufacturing Company. He got that job because of his hard work. Can you believe that at the age of six he was a **card tender** in a cotton mill? Just imagine working 12 hours a day for six days every week and hardly ever going to school. Ambrose only had six months of schooling in his whole life, yet he educated himself by reading books on history, mathematics, literature and more, every night. As he grew older, he was given better jobs and gradually moved to higher positions in the company. Then in 1879 he was asked to be the manager for the Newmarket Manufacturing Company. He was 45 years old.

Ambrose managed the Newmarket mills for 23 years. He built 3 new factory buildings. Ambrose also added new water wheels to provide more power to run the new engines he installed. He improved the water supply to the mill and put in better lighting systems. He also built 23 **tenement** houses. **Tenement** houses were buildings where the employees lived. Usually many families lived in the same building. Families came from many countries in Europe to work in the mills, including Ireland, Italy and France. Many came from Canada, as well.

When the cotton business was slow, he learned about the silk industry. Once he knew what his mills needed in order to produce silk cloth, he converted some of them. When he retired in 1903, the company was producing 18,000 yards of silk each week, enough to make hundreds of silk dresses and shirts for the wealthier people of the East.

He was over six feet tall and was known for his honesty, charity and friendliness.

Newmarket Manufacturing Company

In the early 1820s businessmen from Salem, Massachusetts visited Newmarket. They were looking for a location for a cotton mill. Why do you think they were interested in Newmarket? Probably the first thing that drew them to this town was the water power that could be generated by the first waterfalls on the Lamprey River. They formed the Newmarket Manufacturing Company. Agents for the company began buying up all the land that was available, especially along the river bank. In the next 80 years, they built 6 large mills in Newmarket, all of which are still standing.

In 1824 mill Number 1 was built. It was made of granite blocks and sat at the edge of the river. There were 2,523 spindles in this mill. A **spindle** is a rod that twists, holds, and winds thread. Raw cotton was spun onto the spindles by machines that ran on water power.

In 1825 mill Number 2 was built. It was also made of granite and lay at the edge of the river next to Number 1. By 1829 mill Number 3 was operating. This mill was across the river from mill Number 1 and was connected to it by a bridge. Both of these mills used water power to operate spinning machines. Just think how much thread was being produced. Mill Number 2 was destroyed by fire in 1857, but was replaced in 1858.

Then, in 1869, mill Number 4 was erected. It was a large slate building behind mill Number 2.

By this time the company had 500 people working there, threading the 39,000 spindles that provided thread for the 906 looms. A **loom** is a machine that weaves the thread into cloth. Each week, 160,000 yards of high quality cotton cloth were produced. That's about 90 miles of cloth. Some of the people who worked in the mills were young boys and girls. Imagine working 11 or 12 hours a day breathing dust and lint all day long, with only Sunday for a day off. They didn't have time to go to school to learn to read and write. Their parents were usually millworkers also.

The total payroll for a month was $11,000. That means when you

add up what each person made in a month, the total was $11,000! What's $11,000 divided by 500? It was not very much money after working for a whole month if it were now, but about 150 years ago, it was a fair amount.

Up to this point all the buildings were made of granite or slate, but mill Number 5, which was built in 1881, was made of brick. The brick probably came from the brickyards on the banks of rivers like the Lamprey. It was a large two-story building with a tower and a basement. This mill was right next to Number 4. It was filled with looms.

Now the company had 55,000 spindles and 700 employees who were producing 300,000 yards of material each week That's close to 170 miles of cloth. The monthly payroll was $17,000. What's $17,000 divided by 700? Is the pay increasing?

Mill No. 6 was built in 1892. It was connected to Number 5. Mill No. 7, constructed in 1901, was on the other side of the river, next to mill Number 3. It was also used for weaving. By 1908 the company had added 5,000 spindles for a total of 60,000. Its looms could weave 2,750,000 yards of **pongees, satins, mulls, and taffetas** in a year, which amounted to 1562 miles off cloth worth about $1,500,000. They continued to weave cottons, as well.

The story of the mills has a sad ending. The company and the town went through some very difficult times in the 1920s. The owners packed up everything and moved the business to Lowell, Massachusetts in 1929.

Why did this happen? The workers had gone on strike and wanted higher wages. The first strike was in 1921, but the company owners said they could not pay more. In fact, they asked their workers to take a cut in pay. They said there were many reasons for this. First, the silk thread being sent to the company was of very poor quality and they were having trouble selling the fabric they produced because of this. Also, people were beginning to use new fabrics, like rayon and nylon, which were made out of artificial fibers, so they weren't as interested in buying materials made of silk.

Piscataqua Packet Captains: Nathaniel Keys, Stephen Twombly, Samuel Twombly, Lemuel, William and George Drew. Gundalow Captain: Harrison G. Watson

Do you know anyone who has the same last name as one of the captains listed above? Many of these captains' descendants live here.

During the nineteenth century a **packet** service existed between Portsmouth and the Lamprey River. At first **gundalows** transported coal, cotton, and other supplies from Portsmouth to the mills in Newmarket, then carried the finished product back to Portsmouth. There the cargo was loaded onto larger sailing ships and transported to other ports.

The first gundalows were small and could carry about 10 tons They looked something like barges, sometimes with a square sail. Then larger boats were built that had more **capacity** and could carry more cargo, up to 30 or 40 tons. They were 60 to 70 feet long. These boats had a single **lateen sail, rudders, tillers,** and small cabins. The record time for a trip from the Lamprey River landing to Portsmouth was 6 hours and 15 minutes. Gundalows had to sail with the wind at their stern and with the tide pushing them along.

Harrison G. Watson (1846 -1928) from Newmarket was captain of one of these larger gundalows. His boat, the Fearless , carried brick for the new mills. The bricks probably came from the brickyards in Durham or Dover. The last gundalow to come into Newmarket was the Fanny M, captained by Edward Adams. You can see an exact replica of his boat at Sandy Point Discovery Center in the fall and in Portsmouth in the summer.

Then different boats, known as Piscataqua packets, began to sail from the towns on Great Bay to Portsmouth. They were designed to transport both passengers and cargo. The fare from Portsmouth to Newmarket was 12 1/2 cents. The service was busiest between 1820

and 1850, before trains came to the area.

The packets were 30 to 40 feet long and carried 15 tons of cargo below their deck. They had tall lateen sails and could be handled by two people. Captain Adams once saw 18 of the red and green packets off Durham Point. They sailed to Newmarket with passengers and bales of cotton and returned with passengers, the finished cloth from Newmarket Manufacturing Company, and other local products.

Nathaniel Keys was builder and captain of the Monroe , a Piscataqua packet. It was launched from Chapman's Wharf on the Lamprey in 1819. Stephen Twombly of Dover was owner and captain of the Fox, one of the first packets in the area. Later his son, Captain Samuel Twombly, navigated the Greyhound. Lemuel Drew of Newmarket owned and operated several packets, the last being the Lion. Lemuel's sons, William and George, built the Factory Girl, which sailed from Newmarket and Dover to Portsmouth.

On July 30, 1873, the Factory Girl transported 19 passengers to Adams Point for a picnic on the Bay. The people were Newmarket residents and employees of the B.F. Haley tailoring company. The picnickers returned to the boat and sailed into Little Bay. Suddenly a strong wind blew the Factory Girl up on a ledge. The packet turned over on its side, spilling the people out into the cold waters. They weren't far from shore, but many of the passengers couldn't swim. Three young girls drowned—Abbie Garland, Millie Moulton, and Jennie Burnham.

Sarah K.

In the early 1700's the towns of Dover and Exeter were growing larger. Businesses were being built. There were shipyards, sawmills, fish salting and packing companies, brickyards, **cooper** (barrel making) shops, carpenter shops, and inns. What was it that first drew European settlers the Lamprey River? Farmers came for the salt marsh hay. Fishermen came for the spring fishing. Hunters came to shoot game. Traders came to **barter** with the Native Americans who lived along the river. But finding mast trees and lumber for building ships, as well as for building houses and making other wood products, was the biggest reason. England, Virginia, the West Indies, the towns in New Hampshire, and other places in New England needed the timber and wood products.

People made their way into the forests of Newmarket, Newfields, Nottingham and Lee, where they began cutting down trees. Lumber and logs were hauled by oxen from the woods to the landing near the mouth of the Lamprey. The tallest, straightest white pine trees were reserved for the King of England's ships until after the Revolutionary War. Most of the timber was shipped to Portsmouth, Dover, or Exeter on gundalows, but some of it stayed in Newmarket.

Shipbuilders and their crews began to build ships right on the banks of the Lamprey. One year, 21 ships were built at the landing in Newmarket. Seven ships could lie in the shipyard at one time. The work was so important **shipwrights** didn't have to participate in militia training. How exciting it must have been when a crew finished their work and was ready to send a new ship down the river, and out into Great Bay. The day a ship was launched was a time of celebration for the whole town.

According to Nellie George in Old Newmarket, one of the ships built at Newmarket was the brig Rokeby. It was launched and taken down through the bays and Piscataqua River to Portsmouth where it

was outfitted and placed under the command of Captain John Parrot.

General James Hill, a **shipwright** from Newmarket, got the timber for the war ship America at the landing. The America was one of the largest ships built on the east coast at that time. When she was completed she had 74 guns or cannons. The Continental Congress ordered that she be built in 1776. She was designed by William Hackett of Exeter. Congress sent John Paul Jones to Portsmouth to oversee the construction of the ship. Captain Jones was a famous sea captain who commanded war ships for America during the Revolutionary War. You can see his house in Portsmouth. It is open to the public in the summer.

The America was launched in 1782 and given to France. This was disappointing to Captain Jones, but Congress didn't have the money to outfit her. Also, the French ship Magnifique had sunk in Boston Harbor trying to help our country during the war, so the America was a gift from our country to a friend and **ally**. It replaced the Magnifique and became part of the French Navy.

Sam E.

JONATHAN AND SUSANNAH CLARK

Northwood

Northwood Ridge is the source of the Isinglass, Lamprey and Suncook rivers. Water flowing down the eastern side of the **Ridge** forms the Lamprey River that reaches the Great Bay in Newmarket and eventually, the Atlantic Ocean. Water flowing down the other side forms the Isinglass and Suncook rivers. Both of these rivers pour into the Merrimack, which empties into the Atlantic Ocean in Massachusetts.

Jonathan and Susannah built their home on Northwood Ridge around 1780. They planted an elm tree in their yard soon after the house was finished. Because the Ridge has a clear view of the Atlantic Ocean, ships sailing into Portsmouth Harbor used the Clark's elm tree as a landmark. In the 1920s the huge Clark elm was damaged by fire and had to be cut down, after living almost 150 years. If the tree could speak, think of all the events and people it could have told about.

Philip and Jonathan Hoitt — Northwood

Philip Hoitt was born in Northwood in 1771. He married Dorothy Godfrey in 1790. By 1794 he and Dorothy were living on the eastern side of Saddleback Mountain which is near the southern border of Northwood. Philip and his son, Jonathan, gradually added land and buildings to their farm.

Like many farmers of the time, the Hoitts raised sheep, then spun and wove the sheep's wool to make their own clothing. They also raised flax, which was woven into linen or **linsey-woolsey**, a cloth made from flax and wool. Other items produced on their farm were soap, candles, quilts, rugs and shoes.

The Hoitts carried on two other activities at their farm that were not as common to most farms in the area. They made their own pottery and wooden ware. The Hoitts' pottery was called **redware** because it was made of brick clay. This type of clay is red because it contains iron oxide. Today, no one knows where the Hoitts' clay came from. Were there deposits of clay along the streams that flowed near their home and eventually poured into the Lamprey River? Perhaps the clay came from Epping, where there were many clay deposits. Their pottery was made behind their home, in a small building that had a foot-powered potter's wheel and shelves where the pottery dried. Outside the shop was a **cylindrical** brick kiln with a **domed** top where the pottery was fired for 25 hours. Then the redware was glazed and fired again. The Hoitts made plates, cups, pots, and pans in their shop.

On a stream below their home the Hoitts also had a woodworking mill. Water power operated a **lathe** where plates, spoons, and other items made of wood were created. When a shovel or rake handle broke, Jonathan probably ran down to the mill to make a new one.

The first Dudleys to come here were active in politics and church affairs. Thomas Dudley was the first member of the family to come to America. He arrived in 1630 and was governor of the **Province** of Massachusetts. One of his sons, Joseph, was also a provincial governor. Another son, Samuel, became the pastor of the Congregational Church in Exeter in 1650.

Colonel Stephen Dudley, grandson of Reverend Samuel Dudley, was born about 1688 in Exeter. He was a shoemaker who wore a red coat, ruffled shirt, and powdered wig. He married Sarah Davidson of Newbury, Massachusetts. Stephen purchased land, now Raymond, from an Indian **sagamore** or chief, and probably built the first sawmill in that town around 1725.

The area where Stephen Dudley built his mills was called Freetown and his mills were known as the Freetown Mills. They were located on the banks of the Lamprey River. On the west side of the river the Dudleys had a grist mill for grinding corn and wheat. Its wheel was ten feet in **diameter** and stood upright. The sawmill was on the east side of the River and had a straight saw blade that moved up and down as a log was pushed, end first, against it. The log would be run through the saw several times to make flat boards.

There is an old picture of Mr. Dudley's Freetown Mills that shows a bridge crossing the river beside the mills. In the picture, two men are washing their sheep in the river while another rides over the bridge on horseback.

As settlers moved west, Native Americans resisted their advance. John Dudley, Stephen's brother was killed in the nearby town of Fremont in 1710. He was just 18 years old. Another brother, James, was born in 1690. He was a **cooper** (barrel builder) and a lieutenant in the militia. He was the father of Judge John Dudley of Raymond.

Lesson 6

A Message to the Lamprey River

Overview:
This lesson gives students the opportunity to express their ideas and newly gained knowledge about the Lamprey in a self-selected style. Students will have spent time during previous lessons learning about the many fascinating aspects of the River. They will now have the opportunity to write a letter, sketch or paint a picture, or design a self-expressive project honoring the Lamprey River.

Focus:
How will each student express ideas and newly gained knowledge about the River?

Duration:
varies with the individual project

Learning Objectives:
Students will be able to:
- express their knowledge about the Lamprey River
- design a project which shows an appreciation of importance of the Lamprey

Materials:
To be determined individually by students, depending upon their project

Procedure:
1. Have students gather their science/personal journals, maps and any other materials they have collected pertaining to the Lamprey River.

2. As a group, discuss what students now know about rivers and in particular what they now know about the Lamprey River. Allow students to refer to their journals and notes during the discussion.

3. Explain to students that they will be designing a project in which they in some way express the importance of the Lamprey River to their school and local community. Allow students time to discuss ideas they might have as to how they could do this. Some suggested projects might be a letter written to the River, a sketch or watercolor painting of a favorite spot along the River, a brochure outlining some important features of the River, a timeline showing the historical development of the River, a products map showing the variety of items which were produced or transported on the Lamprey River, a research paper on one of the many individuals who lived on or made their living from the Lamprey River or a play written about the River.

5. You may want to end your Unit study about the Lamprey by inviting parents, school community members, and community members with an interest in the Lamprey River to a "River Festival" at which your students share their projects.

Dear Lamprey River,

I have learned a lot about you. I know all the towns that you travel through. I learned that you have been here for a long time and that you helped lots of different people.

I liked learning about the Native Americans best. They used you to get from one place to another in their canoes. They made their canoes out of trees that lived close to you. They also got food from you. Did you like having them use you to survive?

When I saw you at Betty's Meadow you were very small. In Newmarket you were big. I liked watching the birds and animals.

In the summer I swim in you and in the winter I like to ice skate on you.

Thank you for being so kind.

Your friend,
Cynthia

Dear friend,
I wrote this poem about you:

Swiftly flowing, quietly going
Water deep and cold.
Gently singing
Loudly ringing
Running big and bold.

I had fun learning about you. I hope I can visit you again.
Sincerely, Nora

RESOURCES

Note: The following resource list is divided into four sections: (1) General Resources includes books, videos, articles, pamphlets, natural history guides and historical society files; (2) Children's Fiction; and (3) Activity-based Presentations; and (4) Resource People and Historical Societies; and (5) addresses of Science Supply companies. Those programs that are starred (*) are available through Sea Grant Extension's Marine Education Resource Center, Kingman Farm, University of New Hampshire, Durham, N.H., 03824. (603) 749-1565.

General Resources:

An Unchartered Town: Newmarket on the Lamprey - Historical Notes and Personal Sketches," by Joseph Harvey, **The Granite Monthly: A New Hampshire Magazine**, Volume 40, pp. 33-76, 1908.

A Bicentennial History of Epping, New Hampshire, by Richard B. Sanborn, 1994.

A Brief History of Highland House, by Richard Lord.

***Drowned Valley: The Piscataqua River Basin**, by John P. Adams, University Press of New England, 1976.

"Cultural Resource Assessment, Phase 1," **Wiswall Falls Hydro-Electric Project**, 1985. by Charles E. Bolian and Jeffrey P. Maymon.

Earth Science Library: Rivers and Lakes, by Martyn Bramwell, Franklin Watts, 1986 .

Eyewitness Books: Pond and River, Dorling and Kindersley

Eyewitness: Pond and River, narrated by Martin Sheen, BBC World wide Americas and D.K. Vision, 1996 (video, 35 minutes).

"Items Sought Which Tell Lee's Past," by Renata Dodge, **Transcript**, Volume 5, No. 34, July 8, 1980. Ms. Dodge collected information on the Lee area for many years. These documents can be seen by appointment at the Lee Historical Society.

History of Epping, New Hampshire by John J. Tilton, 1941.

Lamprey River Resource Assessment, by Margaret Watkins, 1994.

Lamprey River Village, the Early Years, by Sylvia Fitts Getchell, Newmarket Press, 1976.

The Lamprey River Watershed Guide, edited and designed by Cynthia Lay and Barry Kane, Foster's Daily Democrat.

Landmarks in Ancient Dover, New Hampshire, by Mary P. Thompson, Durham Historical Association, 1965.

Lee Historical Society Folders about Dr. Isaiah Edgerly, Reuben Hill, Robert Parker and Wadleigh Falls.

Lee in Four Centuries by Ursula Baier, Editor, 1966.

Lee, New Hampshire by John Scales, 1916.

National Audubon Society Pocket Guides, Alfred A. Knopf, Inc. Birds, Lakes and Rivers, Butterflies, Flowers, Insects and Spiders, Mammals, Mushrooms, Reptiles and Amphibians, Rocks and Minerals, Trees, and Waterfowl.

National Audubon Society Nature Guides: Wetlands, by William A. Niering, Alfred A. Knopf, Inc., New York, 1998.

Nature Crafts for Kids, by Gwen Diehn & Terry Krautwurst, Sterling Publishing Co., Inc., 1992.

The New Hampshire Atlas and Gazetteer, DeLorme Mapping Company (Use newest edition available).

Old Newmarket, New Hampshire: Historical Sketches. The Newsletter Press, 1932.

Peterson First Guides: Trees, by George A. Petrides, Houghton Mifflin Company, 1993. Also, Birds, Butterflies and Moths, Caterpillars, Fishes, Insects, Mammals, Reptiles and Amphibians, Rocks and Minerals, and Wildflowers.

A Pictorial History of Raymond, New Hampshire, 1764 to 1976, Raymond Historical Society.

***Ports of the Piscataqua**, by William G. Saltonstall, Harvard University Press, 1941.

A Preliminary Cultural Resource Survey of the Lamprey River Drainage, by Jeffrey H. Maymon, 1983.

Registration and Description of the Wiswall Falls Mill Site, by Peter H. Scott of P.H. Scott Consulting Services for the National Park Service, 1987.

A River Ran Wild, by Lynne Cherry, Harcourt Brace & Company, 1992.

***River Story: The Lamprey River Through History,** Lamprey River Advisory committee and Ideaworks, 1999. (video, 20 minutes).

Some Data on the Lamprey River by Donald Sanborn, 1994.

The Tide Turns on the Lamprey: Vignettes in the Life of a River—A, History of Newmarket, New Hampshire, by Sylvia Fitts Getchell, Capital Offset Co., Inc., 1989.

The Wadleigh Falls Site: An Early and Middle Archaic Period Site in Southeastern New Hampshire, by Jeffrey H. Maymon and Charles E. Bolian, 1992.

Wadley's Falls. by Frank A. Davis, M.D., 1965.

Children's Fiction:

Letting Swift River Go. by Barbara Cooney, Little, Brown & Co., 1991. (This is about the building of the Quabbin Reservoir in Massachusetts and describes life on one of the rivers that was flooded by the waters held in the Reservoir.)

Down the Mast Road by John M. Duncan. McGraw-Hill, 1956. (Imagine yourself a young person going with the men and more than 20 teams of oxen into the woods to fell the huge white pine trees that were used as masts for the sailing ships.)

Lyddie, by Katherine Paterson. Lodestar Books, Dutton, 1991. (A young girl begins to work in the cotton mills in Lowell, MA. Long hours, small pay, but a chance to learn many things.)

Hannah's Fancy Notions by Ross. Once Upon America series. Puffin Books, 1992. (Hannah works in a factory that produces laces, buttons, ribbons and other "fancy things." It helps the reader learn what mill workers' lives were like.)

Activity-based Presentations:

***Watersheds**. Presented by the UNH Marine Docents through their SEATREK program, it focuses on importance of protecting watersheds and includes model building, explorations with the Enviroscape, and a non-point pollution component. (1 hour, cost: $40)

***What's so Great About Great Bay?** A slide program which presents the Great Bay Estuarine System. A short description of the Lamprey River is a part of the program. SEATREK program, (1 hour, cost: $40)

Resource Organizations and People:

Historical Societies: Historical society museums have many artifacts that help us learn things about our ancestors. The people connected with the societies have lots of information to share or know a source that will help you learn more about your subject. Since chairmanship of the societies changes rather often, we are providing a list of people who are connected to the historical society in their town. You may want to contact them for more information.

Candia:	Mable Brock 483-2308
Deerfield:	Roger Hartgen 463-7114
Durham:	Museum number ..... 868-5436 Richard Dewings..... 868-7523
Epping:	Museum number ..... 679-2944 PO Box 346, Epping, N.H. 03042
Lee:	Marge Keeler 659-5925
Newmarket:	Museum number ..... 659-7420 Open Thursdays 2:00-4:00 Memorial Day to Labor Day
Northwood:	Janet Clark 942-8506
Nottingham:	Duke Delp ..... 679-5739 Joy Gannett 679-1937
Raymond:	Ramona Stevens 895-2927

Lamprey River Advisory Committee

Judith Spang, Chair 659-5936
Sharon Meeker, Outreach Chair 659-5441

Science Supply Companies

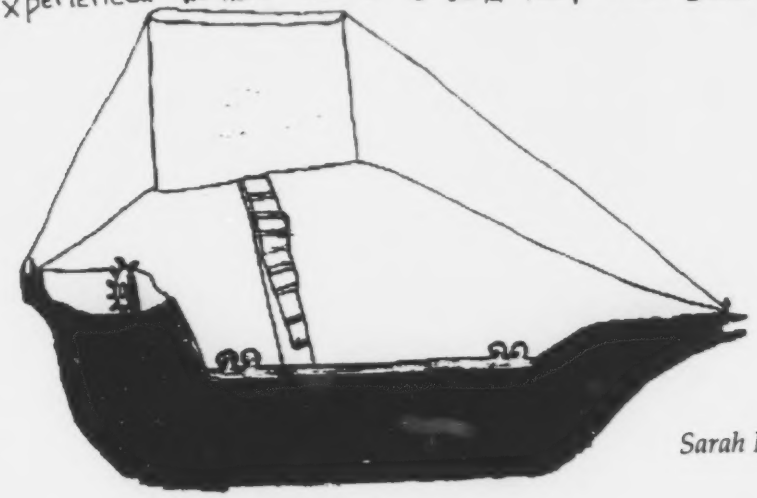
LaMotte Company, P. O. Box 329, Chestertown, Maryland, 21620
(410) 778-3100.

CHEMetrics, Inc., Route 28, Calverton, Virginia, 20138
(800) 356-3072 (540) 788-9026

HELP WANTED!

Crew wanted for shipbuilding for Captain Robert Parker.

Experienced workers wanted to build the privateer General Sullivan.



Sarah K.

Mr. Hoitt making "red ware" pottery

Brooke P.

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SUPPLEMENT:

THE LAMPREY RIVER CURRICULUM

FOR MIDDLE AND HIGH SCHOOL CLASSROOMS

INTRODUCTION

The Lamprey River Curriculum was written to complement the eighteen-minute film, *River Story: The Lamprey Through History.* The focus of the film is the interaction of the river and the people who have lived near it, with a secondary emphasis on the natural history of the river. A theme for this curriculum might be, "The river works for the people and the people work for the river." The following ideas for using the film in middle and high school build on the curriculum designed for elementary schools. Teachers should refer to the elementary portion of the curriculum in using this guide. Specific page and lesson references to the elementary curriculum are included in the following material.

The study of a watershed such as the Lamprey River offers an ideal vehicle for an interdisciplinary study of natural and social history in order to help students gain a deeper awareness of their immediate community and a basic understanding of the ecological connectedness of people and their natural environment. Because the Lamprey is a local resource, students can learn through first hand experience. The role of the teacher is to facilitate experiences in which students observe, problem-solve, research, and analyze.

The lessons build from general concepts about watersheds and varying and changing points of view toward natural resources, to specific activities such as mapping the Lamprey, keeping a journal, viewing the film, conducting research and art projects, taking a field trip to the river, and problem solving about present and future stewardship of the river. Teachers using the whole curriculum will introduce journals, then start with "Background Activities," view the film, and divide the class into research project groups. The fieldtrip, monitoring activities, and artistic responses can be done in connection with the research projects or at any time during the unit. The unit ends with project presentations and a choice of case studies on recent and current decisions affecting the Lamprey. The material is best used as an entire unit, but individual lessons can also be effective.

NH Social Studies Standards Supported by This Curriculum

I	**Ongoing Activities**	6, 7, 8, 10, 11, 12, 13, 14
II	**Background Activities**	6, 7, 8, 10, 11, 13, 14, 15, 16, 17
III	**Projects**	4, 6, 7, 8, 12, 13, 14, 15, 16, 17
IV	**Land Use Issues**	4, 6, 13, 14, 15, 16

Refer to standards listed on page one of the elementary portion of the curriculum, plus:

Curriculum Standard 4: Students will demonstrate an understanding of the meaning, rights, and responsibilities of citizenship as well as the ability to apply their knowledge of the ideals, principles, organization, and operation of American government through the political process and citizen involvement.

NH Science Standards Supported by This Curriculum

I **Ongoing Activities**	1a, 2a, 2b, 2c, 3b, 4c, 6a, 6d
II **Background Activities**	2e, 2f, 4c, 3b, 6b
III **Projects**	1a, 2a, 2b, 2c, 2e, 2f, 3b, 4c, 6a, 6d
IV **Land Use Issues**	1a, 2e, 2f, 3b, 4c, 6a

Refer to standards listed on page three of the elementary portion of the curriculum, plus:

Curriculum Standard 2e: Students will demonstrate an increasing ability to understand that science and technology can affect individuals, and that individuals in turn can affect science and technology.

Curriculum Standard 2f: Students will demonstrate an increasing ability to understand that progress in science and technology is controlled by societal attitudes and beliefs.

Curriculum Standard 4c: Students will demonstrate an increasing ability to understand that the Earth contains a variety of renewable and non-renewable resources.

Curriculum Standard 5c: Students will demonstrate an increasing ability to understand the relationships among different types and forms of energy.

Curriculum Standard 6a: Students will demonstrate an increasing ability to recognize parts of any object or system, and understand how the parts interrelate in the operation of that object or system.

Curriculum Standard 6b: Students will demonstrate their understanding of the meaning of stability and change and will be able to identify and explain change in terms of cause and effect.

NH Language Arts Standards Supported by This Curriculum

I	**Ongoing Activities**	2, 3, 5, 6, 7
II	**Background Activities**	2, 3, 5, 6, 7
III	**Projects**	1, 2, 3, 4, 5, 6, 7
IV	**Land Use Issues**	1, 2, 3, 5, 6, 7

Curriculum Standard 1: Students will demonstrate the interest and ability to read age-appropriate materials fluently, with understanding and appreciation.

Curriculum Standard 2: Students will demonstrate the interest and ability to write effectively for a variety of purposes and audiences.

Curriculum Standard 3: Students will demonstrate the interest and ability to speak purposefully and articulately as well as listen and view attentively and critically.

Curriculum Standard 4: Students will demonstrate competence in understanding, appreciating, interpreting, and critically analyzing classical and contemporary American and British literature as well as literary works translated into English.

Students will demonstrate competence in applying the interactive language processes of reading, writing, speaking, listening, and viewing to:

Curriculum Standard 5: gather and organize information in a variety of subject areas;

Curriculum Standard 6: communicate effectively; and

Curriculum Standard 7: succeed in educational, occupational, civic, social, and everyday settings.

I. Ongoing Activities

A. Journals

Overview:
Students should have a journal dedicated to this unit for in-class and on-site writing. The journal can be used for free writing, note taking, drawings, photos, and drafts of creative writing and opinion pieces. Journals can be purchased or homemade and can be decorated by students with river themes.

Learning Objectives:
Students will:

- increase their observation and thinking skills through note-taking and response writing
- experience a variety of journal keeping styles and ways of writing about nature

Materials:
___purchased or student made journals

Procedure:
When students take a field trip to the river or go on their own, they should write in their journals about what they see and experience. Students could be assigned to visit the river once a week for a month and write about their visits. They could also visit the river in different seasons and write comparative entries. There are many types of journal entries, ranging from introspective and philosophical entries such as Thoreau's, to scientific observations such as Darwin's. Many artists keep journals that combine drawing with writing. Journal styles, exercises to sharpen sensory perception, and many ideas for writing about nature are included in the "Nature Writing and Journal Keeping" chapter of *Literature and the Land,* Roux, Emma Wood (see "Resources" p.131). Some ideas, to be used at various points in the unit, are:

- ✓ Pretend to be a drop of water and imagine traveling through the cycle of precipitation, groundwater, stream, river, ocean, evaporation, and back to precipitation.
- ✓ Imagine being a drop of water that begins in the headwaters and travels to the mouth of the Lamprey. What happens along the way?
- ✓ Imagine being a drop of water that starts at your home; how does it get to the ocean?
- ✓ Imagine you are an object or creature near or in the river—e.g. a rock, tree, or fish. Describe the river from the point of view of that object.
- ✓ Read Wallace Stevens' "Thirteen Ways of Being a Blackbird," (see "Resources" p.131) then write "Thirteen Ways of Being the Lamprey."

- ✓ Write a close-up and long-shot description of the Lamprey. Combine the writing with photographs or drawings.

- ✓ Pretend to be a historical character living and working along the river and write a journal entry they might make at the end of the day. Use as much historical information as possible from reading and research.

- ✓ Pretend it is the year 2050. What has happened to the river and its shores? What does the whole watershed look like?

- ✓ Write a dialogue between a river supporter who advocates the "Wild and Scenic" designation (see "Case Studies" p.143, "What Does 'Wild and Scenic' Mean?") and the developer who wants a license for hydropower.

- ✓ Write a poem about what you see, hear, smell, and feel at the river.

- ✓ Write a haiku poem.

- ✓ Find an object connected with the river—a rock, a tree, the river itself, and turn it into a symbol about you or life in general.

- ✓ Imagine floating in the water and sensing the connection between your body, the river, and all of the water in the world. This passage from Loren Eiseley's *The Immense Journey* (NY: Random House, 1957) about floating in the Platte River is an excellent follow-up reading.

> `You have probably never experienced in yourself the meandering roots of a whole watershed or felt your outstretched fingers touching, by some kind of clairvoyant extension, the brooks of snow-line glaciers at the same time that you were flowing toward the Gulf over the eroded debris of worn-down mountains. A poet, MacKnight Black, has spoken of being 'limbed...with waters gripping pole and pole.'...
>
> I lay back in the floating position that left my face to the sky, and shoved off. The sky wheeled over me. For an instant, as I bobbed into the main channel, I had the sensation of sliding down the vast tilted face of the continent. It was then that I felt the cold needles of the alpine springs at my fingertips, and the warmth of the Gulf pulling me southward. Moving with me, leaving its taste upon my mouth and spouting under me in dancing springs of sand, was the immense body of the continent itself, flowing like the river was flowing, grain by grain, mountain by mountain, down to the sea. I was streaming over ancient sea beds thrust aloft where giant reptiles had once sported; I was wearing down the face of time ...I *was* water...

> ...I too was a microcosm of pouring rivulets and floating driftwood...I was three fourths water, rising and subsiding according to the hollow knocking in my veins: a minute pulse like the eternal pulse that lifts Himalayas and which, in the following systole, will carry them away. (p. 16-20)

Teachers can establish a regular schedule for reading and responding to students' journals, and students can also respond to each other's journals. Responses can include questions, points the reader found interesting, or descriptions of similar experiences. Journals can be assessed according to criteria established by the teacher and the class ahead of time, for example length, effort, regularity of entries, variety, topics covered, etc. They should be graded only once or twice rather than with every response.

Courtesy David M. Carroll

B. FIELD TRIP

Overview:
At some point during this study, all students should have a field trip to the Lamprey River. Students may take field trips to the river as an introduction to their study of watersheds, as part of their research projects, for journal writing and monitoring, and for artistic response activities. They may go as a class trip and make individual or small group visits.

Learning Objectives:
Students will:

- improve observation and data gathering skills from direct field experience
- gather social and natural history information about the river
- record and respond to observations using a variety of media
- formulate questions for further research

Materials and resources:
___student journals
___people with expertise about the Lamprey (see "Resources" p. 133)
___Lesson #4, (p. 22 of the elementary portion of the curriculum): guidelines for fieldtrip and monitoring activities
___www.tenet.edu/teks/web/science/aqua.html has a full high school water-related curriculum with hundreds of related sites, including a link to "Water Walk"
___www.accessexcellence.org/AE/AEC/AEF/1996/isaacs_water.html, an extensive guide to field trips.
___For virtual field trips, visit Yahoo under Recreation/Travel/Virtual_Field_Trips

Procedure:
If the field trip is conducted early in the watershed study, it can be used to generate questions about watersheds in general and the Lamprey in Particular (See section A: 1, p. 106). The class can also schedule a trip to the river while research projects are in progress. Each group or individual could design a trip task based on the subject of their research. Students can also visit the river on their own to do journal assignments or to individually work on their research projects. Details about organizing the trip, including points along the river to visit, group activities, and conducting the water monitoring activities, are described in Lesson #4 of the elementary portion of the curriculum, p. 22-26. While on the trip, the whole group can also do one or more of the creative activities suggested below. Members of the Lamprey River Advisory Committee might be asked to meet the group at suggested stops along the river to co-lead the group's explorations.

To appreciate its beauty and significance, it is important for students to experience the river and its historical sites first hand. But it is equally important to carefully preserve this environment. Students should be cautioned to treat the river and its banks with respect and to follow a "tread lightly" philosophy. They can draw, photograph, and write about their findings but should not collect plants, animals, or historical items, except as individual specimens for the science portion of the curriculum.

C. Creative Response Projects

Overview:
Many creative projects are possible in connection with the Lamprey. Artistic responses can be included in journal assignments. Students can do creative response projects on their own or as class or group projects. Creative projects can also be part of the final presentations for research projects.

Learning Objectives:
Students will:

- experience a range of learning styles to reinforce their study of watersheds
- express observations and share ideas and information about the river through a variety of media

Possible Materials:
___a range of drawing, painting, collage, mobile, and sculpture supplies
___fabric and fiber supplies for quilting and weaving
___costumes, set supplies, and musical instruments for drama
___tape recorder and audiotape, cameras and film, and video camera and tape

Procedure:
Artistic projects need clear guidelines and expectations. Tell students you expect them to spend ten to twelve hours (sometimes more) on a project and show them examples of work that clearly took that long. Have students submit a plan for their project and later write a progress report. Art projects should include a written rationale by the artist and an oral presentation. Ask for a 500-word rationale explaining why the student chose a particular medium and describing the creation process, what the piece is about, what was learned, and how the student evaluates the success of the project. The final, written rationale makes the difficult task of evaluating creative work easier. While it is hard to avoid being influenced by imagination and skill, try to focus on effort and thought in grading these projects.

Some of the following projects are best done by individuals; others require a group. Students can:

- ✓ Write and illustrate a children's book and present it to an elementary school class.
- ✓ Paint or draw a series of pictures of the river.
- ✓ Create a photo journal of the river with accompanying text.
- ✓ Make a video about the river. The video can include visual imagery, historic sites, and a soundtrack, including narration and interviews.

- ✓ Work with others to make a mural about the river. This could be permanent on a wall at school or on large paper.

- ✓ Write and perform music inspired by the river. (Combine the music with natural sounds recorded at the river.)

- ✓ Make a compilation tape of songs that you somehow connect with the river. Explain your choices.

- ✓ Make a sculpture, collage, or montage.

- ✓ Make a quilt. Quilter, Merrilyn San Soucie from Newmarket does arts residencies in schools with grants from the New Hampshire State Council on the Arts (listed in "Resources" p.132).

- ✓ Make a weaving with Council artist, Sarah Haskell.

- ✓ Write a play about the river. Themes could include the geological formation of the river, human history along the river, or modern concerns about pollution and preservation. Make sets and perform the script. Genevieve Aichele, theater artist, and Randy Armstrong, musician (NH State Council on the Arts listed in "Resources" p.132), help students write and perform plays with musical soundscapes.

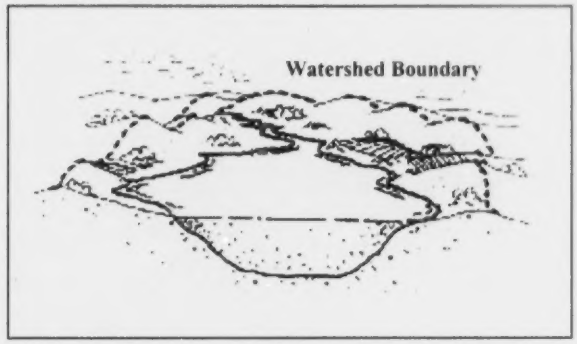
- ✓ Create a dance and movement piece inspired by the river and its history. Use props such as fabric or natural objects, and set the piece to music. Depending on the goals and scope of the project, students might present their pieces in an evening showcase, display their work in a local library or town hall, or give their projects to the community.

II. Background Activities

A. Watersheds and the Lamprey

1. Before looking at a map: Exploring a watershed

Overview:
Students cross streams and rivers every day without realizing how these waterways are connected and without thinking about their own role as residents of a watershed. As the *Lamprey River Watershed Guide* (included) states, "You, and everyone in your watershed, use and impact the same water supply. You are all part of one watershed community." The opening lesson should bring students a greater understanding of this concept.



The *Lamprey River Watershed Guide* (The *Guide*) (p.4) defines a watershed as "an area of land where all water from the area drains into a given stream, river, lake or other water body...Within every watershed, water runs to the lowest point on that landscape—a stream, river, or lake." The Lamprey River Management Plan defines a watershed as "the geographic area that drains into a river, either directly or via tributaries." Students should understand that a watershed refers to a land area, not just water.

Learning Objectives:
Students will:

- understand the concept of a watershed
- become familiar with the Lamprey River watershed

Materials:
___ Student journals
___ *Lamprey River Watershed Guide* (One copy is included with this curriculum. Additional copies may be obtained from The Lamprey River Advisory Committee Outreach Chair (listed in "Resources" p.133)

Procedure:
Before looking at a map of the Lamprey, try one or more of these approaches.

a) Ask students to describe in their journals the body of fresh water (stream, culvert, river, or pond) nearest to their house. What personal experiences have they had in connection with this water? (For example, trying to dam it, catching frogs, fishing,

swimming, ice skating, driving by, etc.) What questions occur to them about the water they described? List their questions.

b) After the descriptions are written and their questions are listed, pose any of the following questions that students did not list, again using journals:

- What is the name of your water body, and where did this name come from?
- Do you know where this body of water begins (where the water in the pond or lake comes from)? ...where it ends? What other bodies of water is it connected to? Where does this fresh water join salt water?
- What drainage ditches, streams or rivers do you cross on your way to school?
- What body of water is nearest to school? Is this water connected to the water near your house? How?
- Where does the drinking water in your house come from? Where does the wastewater from your house end up?
- What watershed do you live in? (How do you know?) What is a watershed? (Give the students the definitions in the Guide if they cannot derive one.)

c) You can also take students right away to an actual watershed and generate a list of questions based on what they see. Their questions may be more immediate in response to a first hand experience. You might be able to walk to a stream or pond near school. If you decide to take a class trip to the Lamprey River early in the unit, refer to the suggestions in Lesson 4 of the elementary portion of the curriculum. You might arrange to have presenters at each stopping point to share information with students. Some of the questions inspired by this trip can help students later determine an area they would like to explore in depth for a project (see section III, p. 115).

d) Contact the UNH Marine Docents Program (Sharon Meeker, 749-1565) for a watershed workshop including an "enviroscape" watershed model and more.

e) A school district may include more than one watershed. Can students describe the boundaries between these watersheds?

f) Once the Lamprey River is identified as a major watershed in your area and the focus of this unit, list a number of locations along the river familiar to students (e.g. recreation areas, home sites, road crossings) and see if students can say which sites are downstream of which. In other words, do they have a sense of the river as a whole, separate from the road system? Chances are, they do not. Once students have generated questions, they are ready to turn to maps of the Lamprey.

2. Mapping: Describing the Lamprey River Watershed

Overview:
Following students' explorations and questioning about watersheds, they will learn the actual nature of the Lamprey River Watershed. (See Lesson 1.2, p. 8 in the elementary portion of the curriculum)

Learning Objectives:
Students will:

- read and interpret topographic and other maps of the Lamprey
- learn the physical characteristics of the Lamprey River

Materials:
___ a large map of the Lamprey River watershed with roads (see enclosed maps); cover maps with contact paper
___ washable markers

Supplementary material:
___ *Mapmaking with Children,* by David Sobel (see "Resources" p. 131)

Procedure:
Start by having students locate their own homes and school on the map. These sites could be marked on the enclosed enlarged class map (or the USGS maps). If the maps are covered with contact paper or laminated, you can use washable marker and reuse the maps. Have students compare their idea about the sequence of locations on the river with the map. Use the map to answer these questions (see Lesson 1.2, p. 8 in the elementary portion of the curriculum for answers):

> Where does the Lamprey begin? Approximately how long is it? (Use string, then a ruler; the length of the river is 47.3 miles from the headwaters to Great Bay) If using topographic maps, how many feet does the river drop in elevation from source to mouth? (600 ft.) What are its major tributaries? What towns does it pass through? What lakes and ponds are part of the Lamprey Watershed? (Have students been to any of them?) Where is the river's mouth? What can you tell from the map about human interventions with the river? (E.g. dams, man-made lakes)
>
> What separates one watershed from another? A topographic map can make the point that watersheds are separated by a height of land, or "divide," even if it's not very high.

Students can confirm their conclusions and answer other questions about physical attributes of the Lamprey while watching the film. For example: How large is the area

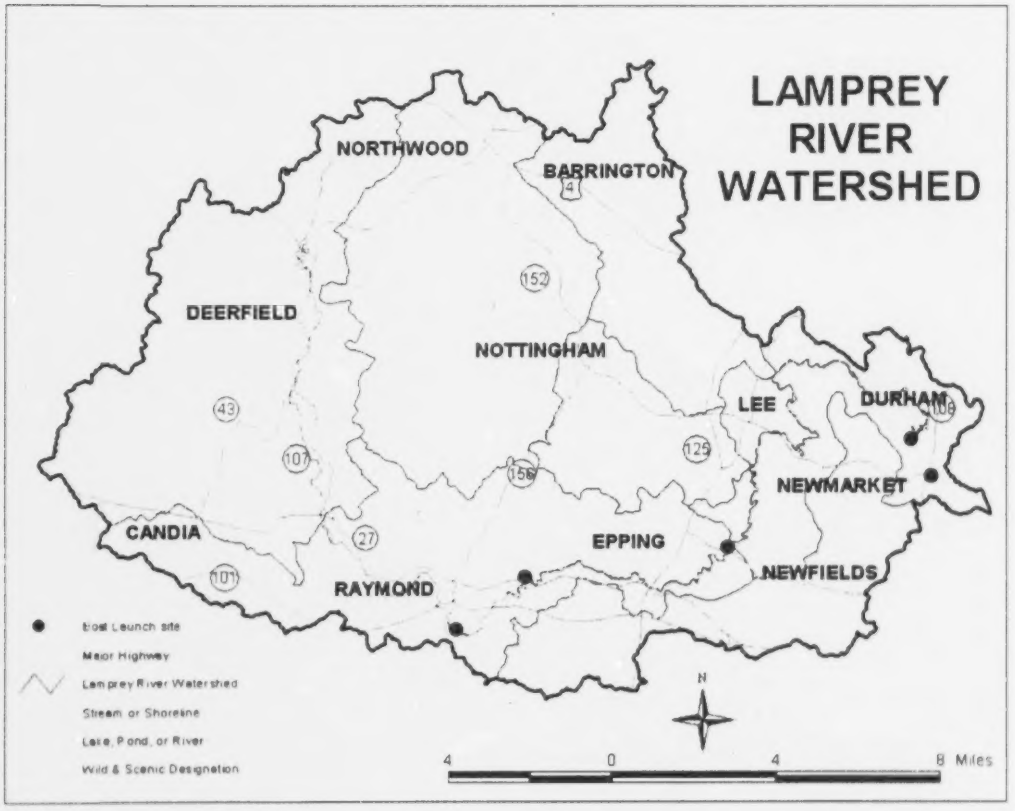
the Lamprey drains? (212 square miles) How much water flows in the river? ("A trickle" to 7,570 cubic feet per second at flood stage; it is the largest river flowing into Great Bay). How did the river first begin (glacial melt water) and where does the water in the river come from now (rain)?

Extensions:

David Sobel's *Mapmaking with Children* has excellent suggestions for a wide variety of mapping activities, including making relief and topographic maps, all appropriate for high school students. Land Sat photographs and GPS data are good supplementary sources of information (USGS Website: http://mapping.usgs.gov/).

Lesson #3, p. 16 in the elementary portion of the curriculum includes directions for groups of students to create town-by-town segments of a map of the Lamprey, to be assembled for a hall or class display. Older students can also gain greater familiarity with the river from this hands-on activity.

Small Lamprey River Watershed Map
(More detailed maps are included with this curriculum)



B: VIEWING THE FILM: "RIVER STORY"

Overview:
The film should move students from their initial familiarity and questions about the river to a deeper exploration of the social and natural history of the river. As the film makes clear, the Lamprey travels "through our backyards and through our history." By studying the microcosm of the river's history in our community, students are studying the larger sweep of history on the American continent. (See Lesson 2, p. 11-14 of the elementary portion of the curriculum)

Learning Objectives
Students will:

- view the film and take notes on uses of the Lamprey River
- construct historical periods based on the river uses they noted
- enter their notes on a chart of historical periods
- analyze reasons for changing patterns of use
- compare Lamprey River history with patterns in American history

Materials:
___video: *River Story: The Lamprey Through History* (18 mins.), TV and VCR
___student journals

Procedure:
Pre-viewing: Ask students to brainstorm (individually in journals then sharing, or listing on the board as a group) ways that humans have used rivers for travel, communication, and survival. Discuss briefly: How have these uses changed over time?

Viewing and Note taking: The film includes a short description of the river's wildlife in the opening section on Native Americans. It then describes the social history of the river town-by-town, downstream from its wild headwaters in Northwood to its highest industrial development at the mouth in Newmarket. The film makes history personal by focusing on specific local families and their sawmills, grist mills, tanneries, guest houses, scout camps, and textile mills.

As they watch the film, have students take notes on specific uses of the river and when these occurred. View the film once without stopping but tell students they will have a chance to view it again. On the second viewing, you can stop the film to give students time to take notes. Following the film, the class will describe and identify periods of history, based on the patterns of use they have noted.

The film ends by stating that the river's "future is truly in our hands." Lessons on decision-making affecting the health of the river come at the end of the unit.

Post-viewing and Charting Change: Review students' notes on uses of the river and organize them chronologically. What patterns emerge? Working in small groups, students can create charts with time periods across the top, and river uses down the left hand side. The groups can come up with the periods and uses themselves, or you can arrive at these headings as a class, then let the groups fill in the chart. Students may not yet have information for every space on the chart, but they can continue to add data as they learn more. A chart form might look like this:

On and along the Lamprey River:	Pre-contact Native Americans 6,000 BC-1500's	Colonial Period 1600's-early 1800's	Industrial Rev. 1800-1900's	Modern 1900-Present
What resources are used?				
What products are made?				
What tools are used for production?				
What are the sources of energy?				
How are goods transported?				
How is the river used for recreation?				
How is the river affected by these uses?				

For example, for "Pre-contact Native Americans," "resources used" would include fish, shellfish, mammals, trees, and stone. The "products made" would include clothing, shelter, hand tools, and canoes. The "sources of energy" would be human (by hand) and fire. The "goods are transported" by the river on canoes and the "river is used" for survival (food and water) rather than recreation. For later time periods, transportation changed from canoe use to horse and wagon, gundalows and ships during settlement, trains in the 1800's, and cars, roads and recreational boating in the 1900's. These changes were made possible by changes in technology and energy from hand power, to wind, to steam engines, to electricity and gasoline engines.

Students can estimate the degree of change brought to the river by these man-made uses along a continuum, with 1 showing little change and 10 a high degree of change. While Native Americans had little effect on the river, the 1800's made drastic changes in the river water and bottom, and the mid to late 1900's began to reverse the effects of this pollution.

Discussion: Many topics for discussion are suggested by observing patterns of river use in the film. For example: How and why have the reasons for fishing and canoeing changed over time? Why do you think recreation and conservation are central to our view of the Lamprey now, but were not as much before 1900? How and why has the use of dams changed? How did the advent of electricity change our perception and use of the Lamprey? How has the Lamprey changed as a result of human impacts? Are these changes good or bad for the river? Do you think the health of the river improved or got worse from 1600-1900? From 1900 to the present? Why? What can we do about our negative impacts? How can we promote positive impacts? These are all questions that can be explored in subsequent projects and discussions.

Extension: Historical activities along the river can be listed by location on an enlarged map of the river. They can also be listed on a chronological timeline which will make clear the progressive shifts from subsistence to light and large-scale industry, then to recreation and conservation.

C. A Lesson in Point of View

Overview:
As the film and chart make clear, people's view and use of the Lamprey River have changed over time. Several exercises can help students consider how our needs influence our way of seeing a natural resource such as the Lamprey River, and how our point of view in turn influences the way we use or abuse that resource. Native Americans and early settlers looked at the river and saw a plentiful food source and a relatively easy mode of transportation. As settlers quickly advanced from a subsistence lifestyle, they also saw the river as a source of power. When electricity carried energy far from its initial power source and roads replaced rivers, we lost our immediate, familiar contact with the Lamprey. What has changed in our current needs and perspective toward nature to make us more aware of the river again?

Learning Objectives:
Students will:

- consider the effects of personality, experience, and need on the way we view nature
- consider how point of view affects the use and treatment of nature

Materials:
___a collection of optical illusions
___various objects for procedure #3
___varied descriptions of something in nature for exercise #4

Supplementary materials:
___*Changes in the Land,* William Cronon (see "Resources" p. 131)
___*Literature and the Land,* Emma Wood Rous (see "Resources" p. 131)

Procedure:
One or more of the following suggestions can be used to initiate a discussion about observation and point of view:

1. Bring in a series of optical illusions (old woman/young woman, the vase or two profiles, holograms, "find the hidden rabbits," etc.) and let students play with them. Discuss: What can be learned about how context, stereotypes, and first impressions influence what we see?

2. Ask all students to describe the same object in writing or by drawing. How and why do their descriptions differ? Can their descriptions be grouped into categories? What? (e.g. realistic, scientific, poetic, symbolic, historical, etc.)

3. Arrange a group of objects in the middle of the room with students seated around the arrangement. What do people see from different parts of the room? How is this

analogous to the way people from different "perspectives" view a resource like the Lamprey River?

4. Read a series of descriptions of something in nature (water, trees, rocks, mountains) and compare what they include in the description with the writers' interests and purpose. Include, for example, a dictionary definition, a myth, a poem, and descriptions from a field guide, a historian, an economist, and a scientist.

Discussion: What different groups have had an interest in the Lamprey and how might their interests have influenced what they saw and how they treated the river? For example, how did Native Americans and European settlers view the river and did their views lead to conflict? How did timber cutters' and mill operators' needs conflict? (Spring log runs jammed mill turbines.) How would a dam developer's view of the river conflict with a river conservationist's view? What do we do when points of view conflict? ...when a human point of view conflicts with what is best for the river? These issues can be discussed again when students do the "Land Use Issues" in section IV.

Extensions: The "Perception" chapter of *Literature and the Land* by Emma Rous describes in detail the effect of point of view on natural resources, using readings, student activities and writing. Chapters on "Myths and The Golden Age" and "The New World" introduce readings about land use by Native Americans, settlers, developers, and conservationists that closely parallel the historical uses of the Lamprey River. *Changes in the Land* by William Cronon describes Native American and early settlers' use of land in New England. Although it is still in draft form, a new book by Dave Allan of Lee tells the story of a Native American boy growing up along the Lamprey. Contact the Lamprey River Advisory Committee Outreach Chair (listed on p. 133 in the "Resource" section) for information on how to get the soon to be released copy.

III. Research Projects

Overview:
Following these introductory activities, students should consider what unanswered questions they have about the Lamprey and devise a series of projects or searches to answer their questions and share their findings. Applying Ken Macrorie's advice in *The I-Search Paper* (see "Resources" p. 131), we know students are more invested in the search for information if they are answering questions they care about. The film and introductory writing, mapping, and discussions should raise a number of questions and issues for students to pursue. *The goal is to find questions, not just topics.* Each research area suggested below includes some background information, questions to consider, suggested procedures, resources, and possible extension projects.

Learning Objectives:
Students will:

- develop their own questions about the Lamprey River watershed to guide their research
- learn research techniques such as locating and reading documentary sources, using reference works, interviewing and recording oral histories, gathering scientific data, and understanding social and natural history from clues on the landscape
- present their findings through a variety of formats and media

Materials:
___reference materials from local historical societies (see "Resources" p. 131)
___audio and videotape equipment
___monitoring supplies ("Teacher's Guide for Experiments and Observations," Lesson #4 of the elementary portion of the curriculum)
___Lamprey River Watershed Guide (included)

Supplemental Material:
___Ken Macrorie. 1988. *The I-Search Paper.* NH: Heinemann.

Procedure:
Students can list their questions individually and/or brainstorm questions in small groups. Once students have selected a question to research, they should be given guidelines for the assignment, options for the final presentation, benchmarks along the way, and criteria for assessment (or a rubric). Students can work with you to develop these guidelines and rubrics. They might write progress reports, turn in notes, or have conferences with the teacher during the research process. Possible areas to research follow.

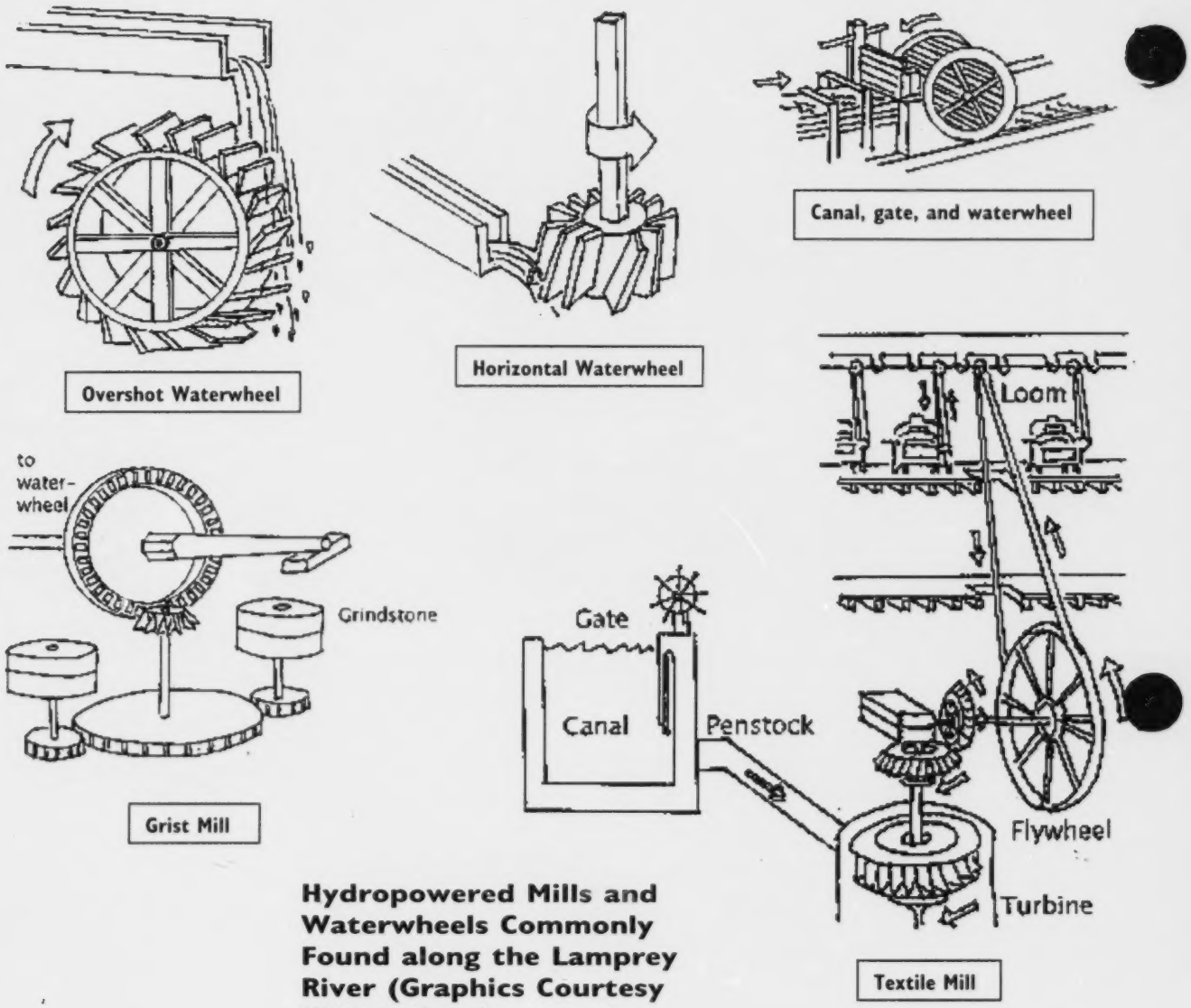
A. Cultural History (and effects on river ecology)

Transportation:

How did Native Americans, several thousand years ago, get red ochre that came from as far away as Maryland? How did the first settlers get the pines they cut for the King's ship masts down to Portsmouth harbor? (By 1776, a third of Britain's ships were built in America, many in Portsmouth.) How did farmers on the river get the firewood they cut in the winter downstream to the brickyards on Great Bay? How did the schooner pictured at the river park in Newmarket make it up the river? Could such a boat get up the river today? Why? The NH state archaeologist's office (271-3558), the Piscataqua Gundalow Project, John Adams' *Drowned Valley: The Piscataqua River Basin,* and a booklet by Adams, *The Piscataqua River Gundalow,* are good resources on transportation on the Lamprey River. In addition to transportation on the river, students should consider how the prominence of first railroads, then cars changed our use and perception of the river. The present, very straight, Route 125 is on the former bed of the railroad mentioned in the *River Story: The Lamprey Through History* film. What forms of transportation are used on the river now, and for what purpose? What problems do motor boats and jet skis pose for the river and its inhabitants? A canoe trip on the Lamprey would be a great extension of this project! Consult the *Lamprey River Watershed Guide* (included) for suggestions on where to canoe.

Energy:

While rivers are still a major energy source, few of us think about how a river's energy is translated into electrical energy. We are also generally unaware of the mechanics of the waterwheels that operated grist mills and sawmills and powered thousands of spindles and hundreds of looms in the Newmarket mills long before electricity. How did this work? You might arrange to tour the Newmarket mills (and perhaps the National Historic Park in Lowell, MA.) Interested students can research the mechanics of various waterwheels and turbines (see diagrams) and might even construct a model. The history section of the Lowell National Park website has animated diagrams of hydropowered looms (www.nps.gov/lowe/loweweb/Lowell_History). The topic of energy lends itself well to collaboration with a science teacher.



Hydropowered Mills and Waterwheels Commonly Found along the Lamprey River (Graphics Courtesy Walter Rous)

How did canals add to a site's waterpower capacity? There is a canal at Wiswall Dam and perhaps the remains of Valentine Hill's canal between the Lamprey and the Oyster River. The Lowell website also discusses canals. Fieldtrips to modern power plants (e.g. PSNH's Newington station or the under-construction, gas-fired Con Edison power plant in Newington) and the remains of dams and canals on the Lamprey should be part of this project. Students can visit PSNH's Amoskeag site in Manchester (634-3315), which includes a fish-viewing window and a small museum.

Manufacturing and business:

Students can look at the history of mills along the Lamprey and learn more about how materials such as grains or logs were processed and how products such as bricks, iron,

leather, medicines, textiles, cider, leather board, or paper are made. Start with a list of questions students themselves generate based on what they learn from the film. They might consider questions such as: Where did the raw materials for these products come from? Where did the finished products end up? How were they transported? How important were these products to the economies of England and America? How did industrial by-products affect the river? Why did certain industries predominate in certain time periods (e.g. sawmills in the 1600's and 1700's, textiles in the 1800's)? Who built and operated the mills and what do we know about their lives? How are their names preserved today? (Have students list names of sites along the river and streets in the area and research where these names came from.)

Students' research can combine the particular history of the Lamprey mills with an understanding of the general manufacturing processes and their role in American and industrial history. For example, if they read a general account of the industrial revolution, they can consider how the mills on the Lamprey fit into the larger picture. Students can see the remains of industrial sites along the Lamprey (e.g. Wiswall dam, Wadleigh Falls, Newmarket mills) as part of their research. Local historical societies can share important information, maps, biographies, and photographs.

Ice cutting: We take refrigeration so much for granted that we are surprised to realize that less than one hundred years ago people needed another way to preserve food. The film answers the most commonly asked question about ice cutting—how did the ice last all summer? What other questions do students have about ice cutting and early food preservation? Students doing oral histories may find older residents who remember buying ice for their "ice boxes" or having it delivered to their homes. Students can also research the processes of pickling, salting, and drying.

Recreation:

A group researching recreation on the Lamprey might start by considering questions such as:

> How is the river used recreationally now? What institutional or commercial recreational facilities exist on the Lamprey now? How do students use it themselves: swimming? the first daring jump off the Wiswall bridge? ice skating? fishing? hunting? canoeing? other boating? hiking along the banks? photography? scenic enjoyment? picnicking? wildlife viewing? skiing? biking? snow mobiling? ATV riding? camping? Which of these uses would not have been considered recreational in the past? Why are they now? What is the impact of these uses on the river? How should decision-makers balance river recreation and river preservation?

Students can write personal narratives about any experiences they have had on the river or interview others about their experiences. How important do students consider these recreational uses next to higher impact uses for industry or hydropower? Are any

recreational uses detrimental to the river and how should this be managed? Are these uses compatible with the Lamprey River Advisory Committee's "tread lightly" philosophy? How can use be altered to accommodate this philosophy? Should more recreational uses be encouraged? (See section IV "Land Use Issues" p. 128.) Students can draw a continuum of recreational uses of the river according to the degree of effect each use has on the river (for example, motor boats and jet skis disturb the shoreline and stir up bottom sediments whereas canoes, unless disturbing nest sites, have little effect).

In a 1992 survey of Lamprey River landowners, 65% of the respondents said they lived on the river for the "privacy and solitude of the area;" 51% named its "scenic/wildlife qualities." In another question, the most common use of the river (88%) was "enjoying scenery," with "nature/wildlife watching" ranking second. Other high-ranking activities include walking (72%), canoeing (62%), swimming (58%), fishing (45%), and photography (42%). Results from this survey are published in the Lamprey River Resource Assessment (see "Resources" p.131). Students can also consider constructing their own survey and updating this information. What questions and conclusions do these survey results suggest to students? For example, how would the responses influence decision-makers about developing or preserving the river? Would the conclusions of residents other than shoreline landowners be different? (Students can test this by conducting comparative surveys.) Who should decide the river's future? (See "Point of View" exercises, section II-3, p.113, and "Land Use Issues" section IV, p.128) How can river advocates educate decision-makers about the river and inspire them to protect it?

Finally, students can research past recreational uses of the Lamprey River such as the Lone Tree Boy Scout camp in Deerfield, and the summer resort, Highland House, in Durham. The nationwide, turn of the century "back to nature" movement exemplified by these two institutions caused a new tourist industry, the grand hotel era, and the formation of clubs such as the Scouts, the Sierra Club, the Boone and Crockett Club, and the Audubon Society. What reasons can students give for why this movement occurred at this time? The excellent video "The Wilderness Idea: John Muir, Gifford Pinchot, and The Great Battle for Wilderness" (1989, Florentine Films, Direct Cinema Ltd. P. O. Box 1003, Santa Monica, CA 90410) presents the end of the frontier and the railroads as two reasons for America's new appreciation for nature around 1900. The book *Mountain Summers* by Peter and June Rowan, and the film, *The White Mountains, Place and Perceptions* (UNH Media Services), describe tourist activity in New Hampshire in the 1800's and early 1900's. The University of New Hampshire currently owns Highland House and is trying to decide what to do with it. Students interested in Highland House and its future can interview Richard Lord, Lamprey River Advisory Committee member from Durham.

The Camp Hedding property in Epping was established as the site of a religious summer retreat and camp meeting in 1864 and in 1881 had so many visiters in one day (18,000) that a branch railroad was built to the site. What else can students learn about

Camp Hedding? What exists on the site now? Was this camp unique or part of a larger national movement?

Lamprey Mysteries:

Students can consider questions historians still puzzle over. For example:

An old mast serves as a newel post in a house near Wadleigh Falls. There is another mast in an attic in Newfields. Where did these masts come from and how did they get where they are? What ships were they on? Who built them? Sharon Meeker (UNH Cooperative Extension/Sea Grant, 749-1565) can arrange for students to view these masts.

Where did the Lamprey get its name? In 1652, it was referred to as the "Lamper Eel Riuer," in 1655 as the "lamperele." Did the name "lamprey" originate in Europe or America?

In 1655, Valentine Hill received permission to build probably the first canal in New England to carry water from the Lamprey (at the Moat near Packer's Falls) to his mill on the Oyster River. Was the canal ever completed? No one is sure. Is Longmarsh Brook the remains of his canal? Students can visit the area east of Rt. 108 between Bennett Rd. and Durham Point Road, then follow the water along 108 south of Bennett Rd., and draw their own conclusions.

Students can look at pictures of artifacts found at Wadleigh Falls dating from 7,000 to 8,000 years ago (tools, reptile bones, animal remains) and consider how they got there and how they were used. Students can get resources from the Lee Historical Society and the state archaeologist (Gary Hume, 271-3558). Do not encourage students to visit this fragile site.

Oral History:

Starting with the historical profiles in the back of the elementary portion of the curriculum (Lesson 5, "People of the River," p. 58-85) and the families introduced in the film, students may be inspired to interview people who currently have a connection with the river or know its history well. Students should first decide what they want to know. They can then locate good subjects to interview through local historical societies (see resources on p. 94 of the elementary portion of the curriculum), state and local conservation organizations (p. 20 and 21 of *The Lamprey River Watershed Guide*), and members of the Lamprey River Advisory Committee (see "Resources" p.133 of this curriculum). They can interview the videographers who made *River Story* and learn how they tracked down their sources. They can also contact people who live along the river and use its recreational resources. Any of the projects on transportation, manufacturing, wildlife, or energy can incorporate oral history as a research tool. For example, a wildlife group could interview local people who bird watch, fish or hunt.

Cautions and suggestions: Most students are reluctant to call adults they do not know. A letter of introduction written by the student along with a form letter from the teacher may help to break the ice. So does an initial call by the teacher. Students may feel more comfortable doing interviews in pairs. A few may only go if an adult accompanies them.

Interviewing the Subject:
Students may go into an interview with, worst-case scenario, no questions, or, only slightly better, a list of questions they stick to so rigidly that they never build on the responses of their subject. Start by asking students to brainstorm a list of things they want to know and to frame these points as questions. Talk about the difference between "yes/no" questions, questions with one-word answers, and open-ended questions. (E.g. Do you like living on the Lamprey? versus What are the benefits and drawbacks of living on the river? or What are your concerns about the future of the river?) Also caution students about avoiding leading questions. Then talk about close listening being the most important part of interviewing—listening for interest, not just note taking. Model a good interview in class by interviewing one of the students or another adult yourself. Process the interview when it concludes. How did the interviewer draw out the speaker? What happened if the speaker answered with "yes" or "no?" Did the interviewer start talking about his or her own experiences? Then have students do a practice interview. You might invite a Lamprey River guest to class to be interviewed by the group.

Getting the information down: Students can take notes, tape record, or videotape. Audiotaping requires transcription later, and note taking can detract from natural conversation. One solution is to jot down quotable phrases and hard-to-remember facts like names or dates during the interview, but to wait until immediately after the interview, while the conversation is fresh, to write a detailed summary.

Sharing the information: Sharing can take many forms. Students can write a lively paper profiling the person they interview. They can do an oral presentation accompanied by visual material such as a timeline or poster. They can impersonate the person they interviewed and speak in the first person. Students who videotape could work together to create a documentary about the river, using the interviews as connecting material (audio tape and quotes from papers could be included as well). A panel of speakers might be invited to class. Students can pool what they learned from the interviews on a class map or on a large timeline about the Lamprey's history.

B. Natural History (and effects on human history)

Wildlife Studies:

The Lamprey River Watershed Guide (p. 5) (Included) and *The Lamprey River Resource Assessment* (bound report, available from Judith Spang, 659-5936, or Sharon Meeker, 749-1565), as well as reports by two naturalists who study Lamprey wildlife, David Carroll and George Gavutis (see "Resources" p. 133), are good places to start a wildlife study. Or start by taking a nature walk (with or without a local naturalist such as Kitty Miller from Lee) and see how many species or wildlife signs (tracks, scat, browse marks, bird calls, nests, burrows, etc.) students can observe. The Lamprey River corridor provides rich wildlife habitat. It contains every stream and river sport fish found in New England and is New Hampshire's most significant river for anadromous fish (sea dwelling, freshwater spawning: shad, river herring, Atlantic salmon, smelt, sea lampreys). Doug Grout from Durham handles anadromous fish for NH Fish and Game and is a good resource for students. Bird watchers have inventoried 159 species of birds in Durham, Newmarket, Lee, and Epping, including four state-endangered species. Mammals thrive on the riverbanks and rare mussels and turtles live in its waters.

Atlantic Salmon: Courtesy David M. Carroll

Students interested in a wildlife project might choose a species with an interesting life cycle such as the anadromous sea lamprey or the catadromous American eel. Eels have no jaws or teeth, live in fresh water and spawn in the ocean—the opposite of lampreys. Eels from Europe and America migrate to the Sargasso Sea to spawn, with the elvers returning to the parents' original streams. Sea lampreys have suction mouths and teeth and are parasitic on large fish. They spawn in streams, live out a larval stage in streambeds, then live their adult lives in the ocean (or in the Great Lakes where they are landlocked). For information on lampreys, students can contact Stacia Sauer at the University of New Hampshire and see photos of lampreys at http://www.GLFC.org/lampcon.htm. The Epilogue of *Literature and the Land* by Emma Rous includes a first person account about a group of boys killing eels in the Lamprey. If students read this, they can discuss how we form our attitudes toward different species—why are some animals cute and others repulsive? Why do we protect some life forms and destroy others? How should we change?

Students can examine how the presence of dams has affected anadromous species in the Lamprey. The Lamprey River Advisory Committee has received a federal grant to build a fish ladder at Wiswall Dam. How much of the river will that open up to returning fish? Students can research the workings of a fish ladder and also the efforts of the Fish and Game Department to restock the Lamprey with trout and Atlantic salmon.

For many years, the same pair of mute swans returned to the river (from where?) just above the dam in Newmarket to mate, nest and raise their young. In the spring, the swans often flew or swam very aggressively at canoeists. One man had to be rescued from a swan that swamped his boat and sat on him. This story raises interesting questions about swans: Why did the swan behave as it did? What can students learn about a swan's mating behavior and life cycle? Do the same swans still return? These swans are not native to this area and may intimidate local species. Should we encourage or discourage their presence? Students can discuss these issues with Richard Schanda, Grant Rd., Newmarket, the Newmarket swan keeper.

Students might study a rare species such as the Blanding's or spotted turtle; or an indicator species (indicating the river's health) such as the six types of mussel found in the Lamprey. Notes on these species are available from the Lamprey River Advisory Committee (p. 133). David Carroll has been observing and radio-tracking turtles in the Lamprey for several years. His writing and wonderful drawings and paintings of wildlife, including turtles, may inspire students to incorporate artwork in their wildlife projects. (See *Swampwalker's Journal, Trout Reflections,* and *The Year of the Turtle* by Carroll in "Resources" p. 131). David Carroll does presentations in schools, sharing his knowledge, artwork, and sometimes a live specimen. He speaks eloquently on the loss of wildlife habitat and the need to protect what is left.

Spotted Turtle: Courtesy David M. Carroll

Notes from a naturalist checking on turtles with radio transmitters indicate how critical river shoreline buffer zones are for river wildlife. Eric Rulison tracked two wood turtles which commonly burrowed in ground between the river and an open field that was covered by grass, berry plants, and dogwood. When a farmer cut this buffer zone, the turtles went to the other side of the Lamprey, where the male turtle was later found dead and hollowed out. The lack of teeth marks on the wood turtle's shell and the fact that it had been cleaned out led the naturalists to conclude that a fisher cat had eaten it. Rulison writes, "It is unfortunate that much of the buffer zone was cut. It seems apparent to me that the turtles then left the area, making them sensitive to disturbances." The male turtle was 17 years old, within a few years of breeding age, and could have lived and bred for another thirty years; therefore its loss was serious for this small turtle colony.

Students reading about this episode (see Wildlife Reports available from Judith Spang p. 133) can enter a discussion about the need for habitat protection versus the rights of landowners. What do they recommend to resolve these often conflicting interests? The Lamprey River Advisory Council has developed a brochure for river landowners on managing land for the protection of wildlife habitat and water quality.

The interdependence, or ecology, of species along the river can be a special focus for student researchers. For example, David Carroll emphasizes the importance of beaver dam building to creating and maintaining wetland habitats for fish, turtles, and amphibians. Trees felled in the river by beaver create hiding places for fish. In another example of interdependence, fish carry wedge mussel larvae, an endangered species, upstream to colonize new areas.

The following excerpt from another naturalist's field notes can be shared with students to illustrate what can be discovered by being alert on and along the river. Early in May 2000, George Gavutis canoed the Lamprey from Wadleigh Falls to Lee Hook Road:

> I periodically noted fresh as well as old beaver sign throughout the trip. Hemlock and oak were girdled in numerous places...I noted raccoon, muskrat, and deer tracks in the riverbank mud...Peepers and gray tree frogs were heard periodically as were "trilling" American toads. We repeatedly flushed and chased one male wood duck and a spotted sandpiper for miles downriver until they finally swung back upstream. [Below Little River] there were at least four drake mallards ahead of me on the river now, indicating territorial bonds were already breaking down with the females spending most of their time incubating their eggs. Soon the ducklings will be hatching (hopefully) and the males who don't have re-nesting hens, whose nests were broken up, will begin to congregate in large marshes for their summer (flightless) molt. The hens with broods may end up there as well.

Gavutis noted 48 bird species during this trip, including a broad-winged hawk, great blue heron, meadowlarks, and bobolinks. Later that day he checked several spots on shore to hear the male woodcock's mating call.

> By the time I returned to the vehicle, a male woodcock had begun "peenting" in his diurnal brushy cover, preparatory to flying to his open singing ground to perform his evening flight ritual.... [Later] I could faintly hear at least one and possibly two woodcock peenting and doing their flight acrobatics way back in.

Gavutis heard five woodcocks that evening. Peterson's *A Field Guide to the Birds* says their "low nasal *beezp* or *peent* suggests call of Nighthawk. Aerial 'song' starts as a chippering trill (made by wings) as bird ascends, and bursts like warbling of bubble pipe at climax." This display can be heard and seen at dusk or on moonlit nights in spring.

Students and teachers should take their own trips and field notes—who knows what wonders you will discover! Take field guides with you. Turn the trip into a scavenger hunt. Show students some natural "events," then have them locate (but not collect) more.

C. POLLUTION: CAUSES AND EFFECTS

Industrial, farming, and residential by-products have increasingly degraded the quality of the Lamprey since settlers first arrived in the 1600's. Dr. C. F. Jackson, Director of the Biological Institute in Durham, attributed the rapid decline of food fish such as salmon, cod, shad, and various shellfish to industrial development beginning in 1800. In 1944, he identified factors such as erosion, siltation and sedimentation, dams, weirs, overfishing, chemical pollution, sawdust, and high coliform counts in the rivers flowing into Great Bay, and he recommended the construction of fish ladders and sewage treatment plants. The good news is that since the 1940's, the trend of increasing degradation is reversing, and the Bay and its rivers, including the Lamprey, are showing signs of improvement.

But there is still work to do. *The Lamprey River Watershed Guide* (p. 6) defines "point source pollution" (from a specific place such as a discharge pipe; the only two currently on the Lamprey are the wastewater treatment plants in Newmarket and Epping) and "nonpoint source pollution" (from diffuse sources such as construction sites, dumps, agricultural fields, and road runoff). Students can research on the methods and efficacy of various sewage treatment options, including the pros and cons of the new micro filter system proposed for Epping (contact Epping Conservation Commission, 679-5441). Students can also investigate sources of nonpoint pollution, using local conservation committees and the Nonpoint Source Program at NH DES, 271-3503 as resources. The *Guide* describes many of these sources as well as prevention methods.

Recent findings from the Cooperative Institute for Coastal and Estuarine Environmental Technology (CICEET) program at UNH indicate trends in sources of pollution in the Lamprey and Great Bay. When completed, a "State of the Bay" report will be available from NH Department of Environmental Services, 271-7889 and the NH Estuary Program, 431-9366. Another source of data is the annual report of The Great Bay Watch, UNH Marine Docents Program, 749-1565. Students can use this data to identify pollutants and hypothesize about their sources (e.g. cadmium, a heavy metal in river and bay sediment, was used in tanning). They can also look for trends in degradation or improvement and discuss what is causing these trends.

As part of the group's consideration of pollution issues on the Lamprey, the class can view the powerful and award-winning video *We All Live Downstream*. The 30-minute video discusses the Mississippi River. The film is available with a teachers' guide for $39.95 from The Video Project, Media for a Safe and Sustainable World, 1-800-475-2638, videoproject@videoproject.org

Monitoring and Inventories:

River water monitoring can be done as part of a project about pollution. Small groups working on a project can conduct tests, or the whole class can do them on a field trip to

the river. The monitoring activities described in the *Lamprey River Curriculum* (Lesson #4, p. 22 of the elementary portion) are equally appropriate for high school students. Additional tests, such as one measuring fecal coliform, are described in a small manual, "River Guide for the Lamprey River," available from Jeff Schloss at UNH Cooperative Extension (862-1520). A Sea Grant film, "Great Bay Watch Processing Fecal Coliform Samples," shows Newmarket students working in a lab (Contact Sharon Meeker for information on obtaining a copy at 749-1565). The Lamprey River Watershed Association can share its active monitoring program methods and results in class, with students attempting to explain the spikes and dips in readings at various sites and in different weather (contact, Beth Malcolm, NH DES, 271-2083).

D. Project Presentations

Options for presenting the results of research include:

- An I-Search paper describes questions posed, research techniques, results, and any remaining questions. The paper should include traditional citations of sources. Teachers may ask for an oral presentation along with the paper.

- A poster-conference involves a "science fair" display of each group's findings. Groups explain their work as students circulate around the classroom listening and asking questions. Conference "attendees" do an evaluation form on each group based on quality of the information and presentation. The class is divided in half and the presentations take place over two class periods, so that each student is both a presenter and an evaluator.

- Groups give oral reports that include visual material (photos, video, posters, charts, statistics, Power Point "slides," etc.). In addition to presenting information, groups pose issues and questions for the class as a whole to discuss. These reports can also be evaluated by the rest of the class.

- A good video involves planning, organization, skill and work, and can be a highly effective means of sharing information or an idea. If students have the equipment at home or in school and someone to help them with the technical skills of shooting and editing, this is a great project. Students can look at *The Lamprey Through History* again, concentrating on how the film was made. For example, are close ups, pans, and long shots used effectively? How are historical documents woven into new footage of the river? How does the narration work with the visuals? What is the sequence of images and narration; i.e. how is the film organized, and how effective is the organization? If students do oral histories, this material can be included in the film. Groups can videotape their interviews or use audiotapes of interviews in the narration. A new cable agreement in our area gives students free access to local broadcasting, a great opportunity for sharing student work beyond the classroom.

Students' work could be assembled as a traveling exhibit to communities in the Lamprey watershed. If a number of high schools and middle schools coordinate their activities; the area might stage a Lamprey River "Old Home Day."
Some of the artistic responses described earlier can also be used for project presentations.

IV. Land Use Issues

A. Three Case Studies

Overview:
Having considered a variety of historical points of view and uses of the river, students can now address recent controversies involving the Lamprey and its future. One was the attempt to develop the Wiswall dam for electric power and the subsequent decision in 1996 to designate parts of the Lamprey as a national "Wild and Scenic" river. Another is the question of how much access and recreation to encourage on the Lamprey. A third involves the withdrawal of water for public water supplies versus maintaining water depths and flow for the riverine environment. Any of these "case studies" can be the subject of in-class discussion. While these "case studies" involve some research, the focus is not on a "report" but on engaging in discussion and debate, with emphasis on conflict resolution techniques. This is contemporary history and the people involved are our neighbors!

Learning Objectives:
Students will:

- study primary source materials and interview stakeholders to gather data on current controversial issues regarding the Lamprey
- see each issue from a variety of points of view, and consider costs and benefits (for people and the river) of each view
- consider methods for resolving conflicting points of view
- arrive at a personal resolution of the issues under discussion

Materials and resources:
___case study materials on proposed hydroelectric plant at Wiswall Dam and "Wild and Scenic" designation (Appendix #2, p. 143)
___Lamprey River Resource Assessment ((available from Lamprey River Advisory Committee, (LRAC), see "Resources" p. 133))
___Lamprey River Management Plan (LRAC)
___National "Wild and Scenic" legislation (LRAC)
___*Getting Started in Debate* by Lynn Goodnight (see"Resources" p. 131)
___*Environmental Issues Forums,* Kendall Hunt Pub. Co., on conflict resolution techniques
___members of the Lamprey River Advisory Committee (see "Resources" p. 133)
___Rollie Barnaby, Extension Educator, Taylor Hall, 59 College Rd., UNH, Durham (679-5616), conflict resolution facilitator

Procedure:
Students can use primary sources and interview active participants to explore the issues and come to their own conclusions. As students read this material and talk to

stakeholders, they should always consider the source of the information and how the interests of the writers or speakers influence their views of the river. On what basis would they judge the validity of the documents? For example, why would the developer applying for a hydropower license indicate on his application that there is no recreational use of the Lamprey?

Using the case study materials and interviews, the class might divide into teams to debate (see *Getting Started in Debate*) the pros and cons of each issue:

1. **Granting a hydroelectric license versus declaring the river "Wild and Scenic."** There is plenty of material in support of protection; some research on arguments in support of dams as a source of electric power will help the team making the case in support of the license. Students can also research the environmental record of the dam developer in operating a hydropower station in Dover.

2. **Increased public access to the Lamprey versus a "tread lightly" philosophy.** At the present time, there is no public access to the Lamprey in Lee. The challenge is to diversify use while minimizing impact. How will increased access and more intensive recreational uses, especially motorized, affect wildlife habitat, erosion, scenic impacts, or the quiet desired by passive recreationists? Students might create a continuum of recreational uses, ranging from the highest to the lowest impact.

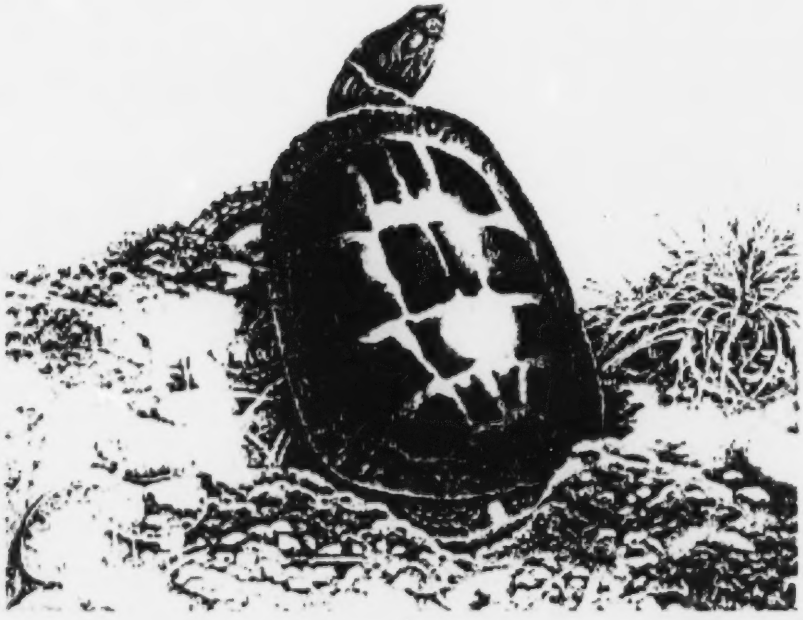
3. **Withdrawing water for public drinking supplies.** Newmarket uses the Lamprey for drinking water. Durham is currently straining its water reserves in the Oyster River reservoir and plans are in progress to build a withdrawal pipe from the Lamprey to the Oyster River. How will this affect water levels and flows in the Lamprey? How will such changes affect the river environment and wildlife? George Rief, an engineer living in Durham, is a resource on this issue.

While the debate format helps students form opinions and use logic and data to support their opinions, a less confrontational format (such as that described by the *Environmental Issues Forums* listed in "Resources", p. 133) can help students explore the complexity of an issue and experience the work involved in resolving conflicting points of view. Students learn the facts and arguments as presented by all points of view, weigh the costs and benefits of each proposal, and try to arrive at solutions that meet the needs of the river as well as its human community. You might organize a debate on one "case study" and a forum on another and invite students to compare the two methods of approaching a controversial public issue. What are the pros and cons of each? How does the winner-loser outcome of a debate compare with the compromise outcome of a forum? What usually happens in political discourse?

B. The Future and Stewardship

Students should end their study of the Lamprey River with a consideration of how we should use the river, now and in the future. The Management Plan suggests some directions for the future such as further study of resources and recreational uses, monitoring water quality, and improving access to upstream water for anadromous fish. What role can each of us play? Students must be reminded that it is not just the river itself that needs safeguarding but the whole watershed. The *Lamprey River Watershed Guide* (p. 6) includes many recommendations for individual actions including care of septic systems, not cutting shoreline vegetation, keeping toxins out of the groundwater, and controlling run-off through planned development. Students can consider how they can advocate for the river and what role they might play in the current unresolved questions about the use of the river. As the film concludes, "Everyone of us who lives along the river or visits it helps create the river's future."

Students should write a concluding piece about what they have learned about the Lamprey, how their attitudes toward it may have changed, and how they will think about the river in the future.



Nesting Painted Turtle:
Courtesy David M. Carroll

RESOURCES

For Middle and High School Curriculum

(See also a complete list of resources on page 91 in the elementary curriculum secton)

Carroll, David. 1999. ***Swampwalker's Journal, A Wetlands Year***. Boston: Houghton Mifflin.

Carroll, David. 1996. ***The Year of the Turtle, A Natural History.*** New York: St. Martin's Griffen.

Cronon, William. 1983. ***Changes in the Land: Indians, Colonists, and the Ecology of New England.*** New York: Hill and Wang.

Environmental Issues Forums. Kendall Hunt Publishing Co., 4050 Westmark Dr., PO Box 1840, Dubuque, IA 52004-1840.

Goodnight, Lynn. 1988. ***Getting Started in Debate.*** Lincolnwood, IL: National Textbook Co.

The Lamprey River Curriculum, especially Lesson 4: Stopping Along the Lamprey: The Field Trip and Teacher's Guide for Experiments and Observations.

The Lamprey River Watershed Guide — a newsprint "magazine" included in each curriculum package; also available from the Lamprey River Advisory Committee, 55 Wiswall Road, Durham, NH 03284

Lamprey River Resource Assessment, Lamprey River Management Plan, and Lamprey River Recreation Plan (in progress). Available from the Lamprey River Advisory Committee (see below).

Macrorie, Ken. 1988. ***The I-Search Paper***. Portsmouth, NH: Heinemann.

"River Guide for the Lamprey River," manual for water monitoring, available from Beth Malcolm, NHDES, 271-7889, or Jeff Schloss, UNH Coop. Ext., 862-1520

Rous, Emma Wood. 2000. ***Literature and the Land***. Portsmouth, NH: Heinemann.

Rowan, Peter and Jane, eds. 1995. ***Mountain Summers: tales of hiking and exploration in the White Mountains from 1878-1886 as seen through the eyes of women.*** Gorham, NH: Gulfside Press.

Sobel, David. 1998. ***Mapmaking with Children: Sense of Place Education for the Elementary Years.*** Portsmouth, NH: Heinemann.

"Wild and Scenic" legislation, available from Lamprey River Advisory Committee (see below).

Detailed maps of the Lamprey River Watershed: maps included with curriculum, rough map on LRAC website, or relevant USGS maps

Video: ***River Story: The Lamprey Through History,*** 18 mins., with curriculum package (see video script in appendix)

Video: ***We All Live Downstream,*** 30 mins., available from The Video Project, Media for a Safe and Sustainable World, videoproject@videoproject.org 1-800-475-2638, $39.95 for institutions. About the Mississippi River.

Video: ***The Wilderness Idea: John Muir, Gifford Pinchot, and The Great Battle for Wilderness.*** 1989, Florentine Films, Direct Cinema Ltd. P. O. Box 1003, Santa Monica, CA 90410

Video: ***The White Mountains: Place and Perceptions***. UNH Media Services. Durham, NH.

<u>Organizations and programs:</u>

Lamprey River Watershed Association, organizes water monitoring on the Lamprey, has a map showing monitoring sites, Barry Kane, 659-3399

National Park Service, Margaret Watkins (advisor to and member of LRAC), PO Box 3176, Manchester, NH 03105; 641-5686

New Hampshire Department of Environmental Services (DES), 6 Hazen Dr., PO Box 95, Concord, NH 03302-0095. Contact: Barbara McMillan, Watershed Outreach Coordinator, 271-7889, for information about the Lamprey River Watershed, or Beth Malcolm, Volunteer Lakes Assessment Program Coordinator, 271-2083, for information on Lamprey River water monitoring

New Hampshire Estuary Program, 431-9366

New Hampshire Rivers Management and Protection, DES, Rivers Coordinator, 6 Hazen Dr., PO Box 95, Concord, NH 03302-0095; 603-271-1152

New Hampshire State Council on the Arts, 271-2789

Sandy Point Discovery Center, Great Bay National Estuarine Research Reserve, Depot Rd., Stratham, 03885; 778-0015 – has kayaks for fieldtrips on Great Bay and lower Lamprey and other programs

UNH Marine Docent Program, Sharon Meeker, Kingman Farm, Madbury, NH 03824; 749-1565 – does workshops on watersheds for schools, including use of a watershed model, the "Enviroscape;" sponsors Great Bay Watch and publishes monitoring data. Sharon lives at Wadleigh Falls and can meet school groups there.

People:

Rollie Barnaby, Extension Educator, Taylor Hall, 59 College Rd., UNH, Durham, conflict resolution facilitator, 679-5616
David Carroll, author, illustrator, and naturalist; did turtle and wildlife studies for the Lamprey River resource assessment study, does presentations in schools
George Gavutis, wildlife biologist who worked on Lamprey resource assessment
Doug Grout, Durham, NH Fish and Game; works with anadromous fish on the Lamprey
Gary Hume, NH State Archeologist, 271-3558
Don and Kitty Miller, Lee, 868-5217, wildlife biologists
George Rief, Durham, resource on water diversion pipe
Richard Schanda, Newmarket swankeeper
Jeff Schloss, UNH Cooperative Extension, water resources and monitoring, 862-1520

Members of the Lamprey River Advisory Committee (LRAC):
Jack Fitzgibbon, Newmarket
Joe Ford, Lee
Brian Giles, Lee
Will Hamlin, Newmarket
Gary Laughton, Durham
Richard Lord, Durham
Kevin Martin, Epping
Sharon Meeker, Lee, Outreach and Education Committee chair, 749-1565
Eileen Miller, Lee
Judith Spang, Durham, LRAC chair, 659-5936
Richard Wellington, Lee

Websites

Adopt a Creek Programs, 4-H Youth/ Adult Science Clubs, Cooperative Extension
Information on monitoring and watershed model building available from janeuhauser@ucdavis.edu

Black River Watershed/Oberlin College/Seventh Generation collaborative project
www.oberlin.edu/~envs/projects
One of five sites piloting the Watershed Education Partners Program sponsored by the Orion Society. A K-12 curriculum.

EPA, Environmental Protection Agency
www.epa.gov/surf
Surf Your Watershed

GLOBE, Global Learning and Observation to Benefit the Environment
www.globe.gsfc.gov/cgi-bin/home.cgi
International student monitoring program, K-12, linking students, teachers, and scientific researchers. Includes teacher guide and toolkit of measuring instruments.

GREEN, Global Rivers Environmental Education Network
Offers *Watershed: A Successful Voyage into Integrative Learning* by the National Middle School Assoc, and a low cost water monitoring kit. Available through Earth Force:
vmeldrum@earthforce.org

Great Lakes Fisheries
www.GLFC.org/lampcon.htm
Images and information on sea (or lake) lamprey

The Lamprey River Web-site by the Lamprey River Advisory Committee
www.lampreyRiver.org

The Lamprey River and the New Hampshire Rivers Management and Protection Program www.des.state.nh.us/rivers/lamprey1.htm

"Living on Earth," National Public Radio
www.loe.org
Search archives by topics, text and audio available to 1992, text only prior to 92.

Lowell National Park
www.nps.gov/lowe/loweweb/Lowell_History
A detailed history of the industrial revolution in England and America, with good diagrams of waterwheels, canal systems, turbines, and hydropowered looms.

National Directory of Volunteer Environmental Monitoring Programs
http://yosemite.epa.gov/water/volmon.nsf
Directory lists over 770 programs with sources of funding. Available on line and from NSCEP 800-490-9198

National Park Service Wild and Scenic Rivers http://nps.gov/rivers/

National Volunteer Monitoring Conference
www.epa.gov/owow/monitoring/vol.html
Organizes conferences on networking, presentations, field t
rips, and exhibits.

NH Department of Environmental Services www.des.state.nh.us/

Project WET (Water Education for Teachers) www.des.state.nh.us/wet/
Curriculum and Activity Guide, K-12, with project coordinators in every state

River Network
www.rivernetwork.org
Programs on monitoring, organizational development, restoration, and protection.

The Rivers Project
www.siue.edu/OSMEriver
Integrates math, biology, chemistry, language arts, geography, and earth science.
Offers materials and teacher training.

Save Our Streams
www.iwla.org
K-12 curriculum from the Izaak Walton League using biological stream monitoring

Texas Education Network
www.tenet.edu/teks/web/science/aqua.html Includes a full high school water-related curriculum with links to many other sites

Water Walk
www.accessexcellence.org/AE/AEC/AEF/1996/isaacs_water.html

An extensive guide to water-related field trips. (See Yahoo under
Recreation/Travel/Virtual_Field_Trips for virtual field trips.)

WOW! The Wonders of Wetlands
www.nsta.org/scistore
An elementary and middle school curriculum with instructions on setting up a field study.

Yahoo!
www.yahoo.com
Environment and Nature category links to many subcategories and sites.

General sites:
www.eelink.net
www.envirolink.org

Appendix #1

VIDEO - "A RIVER STORY: THE LAMPREY THROUGH HISTORY"

This is the film script from the video - entitled "A River Story: The Lamprey Through History."

This is the story of a coastal New Hampshire river, the Lamprey. It travels forty-seven miles through our backyards and through our history, falling 600 feet to sea level. The Lamprey is one of five freshwater "fingers" that flow into Great and Little bays, down the Piscataqua River to the Atlantic Ocean.

In the early years of European settlement the Lamprey River was the dividing line between Exeter and Dover, two of the four original British plantations that became New Hampshire. Once the river was central to travel, communication and survival. Today, we've lost these connections to local rivers. Trains, then cars and planes have changed the way we travel. Phones, TV, and now the Internet have changed the way we communicate. Coal, oil, and electricity fuel our livelihoods.

But we've gained new connections, too, endowing the river with new meaning in our lives. Over time, the river has provided its people with homes and food, with transportation and with power, with everything from recreation to refrigeration -- as our needs change. And, constant through it all, the Lamprey flows seaward.

Draining two hundred and twelve square miles from Northwood to Newmarket, this remarkable natural system carries more water to Great Bay than any other river -- in volumes that range from a mere trickle to walls of water under extreme flood conditions as high as 7,570 cubic feet per second. Whether we know the Lamprey or not, it knows us: our history, our lives today, and our future are all connected with this waterway. The story of the Lamprey is the story of the New Hampshire seacoast.

Whenever we travel this close to a river, we are reminded of the **Native Americans** who knew no cities, towns, states or borders. By radiocarbon dating of the tools and other archaeological remnants found along the New Hampshire seacoast, archaeologists know that Native Americans

occupied this region more than 8,000 years ago. These early residents hunted or trapped local wildlife, fished with traps or "weirs" made of sticks. They lived in what were probably temporary settlements along the Lamprey until disease spread by European settlers decimated their population.

Most of the **wildlife** the Native Americans depended upon and coexisted with are still found in the watershed today. In the spring floodplain pools along the length of the river teem with wood frog eggs. Bugs, berries, and the river corridor's lush vegetation provide food for a variety of wild critters. More than one hundred and fifty species of bird use the river for foraging, nesting, and migration. With a keen eye you may see signs of the river otter, muskrats, mink, beaver, even moose, and bear who live here.

Fish thrive in the river. Some return to the Lamprey from the ocean to spawn. State Fish & Game biologists are measuring river herring and recording their sex and age before they are released upstream. Rare mussels and turtles also find a stronghold in the river corridor -- a testament to the river's good health.

It is so rich in wildlife and history that portions of the Lamprey River were designated a National Wild & Scenic River in 1996. The river is also protected under the State Rivers Management and Protection Program.

NORTHWOOD

Our journey down the Lamprey starts here, at the headwaters in Northwood. The bedrock beneath dates to $00 million years. Melting glaciers provided water during the Ice Age, but another element was needed to keep the river flowing through the millennia -- rain.

This is where the river begins, at its headwaters in Damion Pond, Meadow Lake and Betty Meadows. Much of this area is owned by the State of New Hampshire and can be accessed through Northwood Meadows State Park. The 756-acre preserve, with its forests of hemlock, sugar maples, beech and ironwood, extensive wetland meadows, and Meadow Lake, provides a variety of wildlife habitats. The park offers a haven for human visitors and wildlife alike.

From the road, the thin winding river intermixed with wetlands may appear only at the intersections with small bridges. From the air, the Lamprey may look only like a twisting break in the forest below. As it flows towards the sea, the river widens, creating oxbows or spreading out into the floodplain, always changing.

DEERFIELD

The use we make of any river also changes over time, as our need for that river evolves. Originally, only beaver built the dams along the Lamprey. Then came the manmade dams. During the 1700s at least eight dams were operated on the Lamprey in Deerfield alone, creating ponds like this one and generating the head to run mills. The descendents of colonial mill owner Jacob Freese survived here for two centuries before the family mill and farm finally closed.

Then a new page was turned. In 1928, Freeze's Pond became the center of a whole new idea -- a summer camp. The Lone Tree Boy Scout camp taught outdoor skills based loosely on the traditions of Native Americans. The former Freese farm was adapted to include cabins, an infirmary, a mess hall for one hundred campers in the barn, and a craft workshop built from a carriage shop. The camp survived until 1943 and represents a unique use that drew youth from Massachusetts to the river.

CANDIA

European adventurers came to the Seacoast region in the early 1600s primarily to fish and to harvest the region's straight, tall trees into ship masts and wood for building. Sawmills were needed to cut the wood, and at least fifteen sprang up on the Lamprey and its tributaries.

This Candia mill site was owned by Matthew Patten in the 1700s and operated for more than a century. Even today, enough remains from this reconstructed stone dam to imagine what the mill looked like and how it operated. This footage from a replica site in Massachusetts shows how the mill was critical to early New England life.

Farmers who made their living off the land worked year round. During the winter they cut and stored logs near the river in anticipation of strong spring flows to carry the logs to the mill for sawing. Logs were milled in the spring, and crops were planted. When the river's flow fell off during the summer and the mill had to be shut down, the farmers focused on their crops. With the fall harvest came the rain, and the mill once again was operated to grind grain.

When the trains came through Candia in the mid-1800s, Matthew Patten's mill was used to saw the railroad ties for the Concord to Portsmouth railway -- one of the many lines that linked New Hampshire towns.

EPPING

From Candia, the Lamprey winds through the town of Raymond toward Epping and Lee. At the center of Epping was another dam and another freshwater pond. Here, where there once was a dam, and at many such manmade ponds, locals carried on a traditional winter business of ice cutting.

Imagine a time without refrigeration! The value of ice for cooling is obvious, and over the centuries, techniques for ice harvesting grew more and more sophisticated. By the early 1900s this small scale ice gathering enterprise was a neighborhood affair. Usually in February, the cutting spot was selected, the snow shoveled off, and the first difficult cake drilled, sawed loose, and removed to the waiting sled.

The ice plow scored off three hundred pound blocks, with cuts two to three inches into the surface of the ice. Sawed by hand in a circular motion, blocks were broken with bars into more manageable pieces, and floated to the ice house for storage. Ice cakes were layered with sawdust saved from the sawmills. Properly stored in the ice house, a cake of ice could survive an entire New Hampshire year without melting.

Today ice cutting is a lost art, but the river finds new purpose. Epping's annual canoe race now takes place where the dam used to be. The result is a new and different sense of community spirit, and a renewed link to the river for race participants and onlookers.

LEE

Access to flowing water was critical in establishing new towns. Colonists usually built dams on sites near the same natural rapids and falls that had previously attracted Native Americans and today attract recreationists. The Lamprey shares this heritage. From the modern roadway, Lee appears as a farm town with no industry at all. But here at Wadley's Falls is a reminder of the town's lost factories and commercial center.

The first sawmill here dates to the seventeenth century, when New Hampshire was still governed by the Massachusetts Bay Colony. That tradition continued right through to the 20th century. This is the only location along the Lamprey where a mill straddled the entire river and was powered by a horizontal water wheel. Lumber milled here during the Civil War supported the local shipbuilding industry. A tannery operated here in 1860, and soon after, Doctor Isaiah Edgerly created New Hampshire's first pharmaceutical company here. He reportedly

manufactured as much as twenty-five tons of ground botanical medicines in a single year.

At the turn of the twentieth century, Wadley's Falls was a busy intersection. Here were a hotel with the post office in its front room, two stores, the pharmaceutical company, a cider mill, a saw and planing mill, a tannery, and a shoe manufacturing shop, which was later replaced by a leather board factory. As with all early factories, these industries dumped any polluted byproducts directly into the river. Today, except for the fallen foundations, a visitor might never suspect the bustling activity that once characterized this stretch of river.

But look closer and the evidence is still here. A fire destroyed the leather board factory. Fires were common in these Lamprey factories, many of which were rebuilt time and again. The Wadley's Falls story was repeated here, further down-river, in Durham, at Wiswall Dam.

DURHAM

Historic records and archaeological remains indicate there were at least nine buildings in the large industrial complex that once stood here. A dam and sawmill built in 1835 were followed by a grist and flour mill and various other businesses manufacturing everything from matches, pitchforks, nuts and bolts to gingham cloth, carriages and chairs. At its peak, a paper mill at the site produced twenty-five hundred pounds of paper a day and employed fifteen people.

This abandoned canal shows the elaborate engineering involved. Water was diverted behind the dam into the canal, ran under the paper mill, powered two turbine engines, and returned to the river.

Today the University of New Hampshire is the busiest spot in Durham, but not always. Once sixty percent of the town's capital wealth was invested here. This highly efficient mill complex had its stores and housing for workers. A huge fire in 1883 destroyed the mills, and all but the dam disappeared. Today the former industrial site at Wiswall Dam is listed on the National Register of Historic Places. Ironically, the next use of the dam was to produce electricity, a power source that ushered in a new era when industry could move to locations far from rivers.

Just down the river in Durham, the Highland House represents an example of the "back to nature" movement that helped create the region's early tourist trade. Originally owned and operated during the late 1800s by the S.J. Woodman family, Highland House was acquired by the Thompson family around 1912 and expanded to include two additional guest houses.

For many years visitors came from cities like Boston and New York to enjoy the hearty farm-fresh meals and country environment. Fathers, the advertising brochure said, could commute easily to be with their families on weekends in this homelike atmosphere. As at the Boy Scout camp in distant Deerfield, the Lamprey offered fishing, boating, swimming, even ice skating opportunities. Loyal guests of many years continued to return each summer into the late 1960s.

Today, the property is owned by the University of New Hampshire, which inherited the former country inn, and the house is rented.

NEWMARKET

The Lamprey ends its forty-seven mile run toward the ocean at the river town of Newmarket. Here the industrial use of the river reached its peak. Incorporated in 1822, the Newmarket Manufacturing Company operated from these historic stone and brick buildings. Its size was staggering. In one building alone were nine-hundred-and-six looms, with thirty-nine-thousand spindles. Seven hundred employees created up to three-hundred-thousand yards of cotton products each week, and two million-seven-hundred fifty-thousand yards of silk cloth per year.

At one time the largest weaving room in the world was located here. To maintain power for these operations, Newmarket Manufacturing controlled the river's flow with dams half way up the watershed at Pawtuckaway Lake. Its Great Dam in Newmarket, where fresh water flows into salt water, was the gateway to the sea. Coal arrived by gundalow, a flat bottomed boat distinctive to this region, and finished goods traveled the same way back out to the harbors -- and to the world.

Entire families were employed in the hot, noisy mills for generations, working six days a week for up to sixty-five hours. The mill often owned their homes. The factory whistle and mill bell regulated their days. In 1929 the mill workers went on strike, and the mills were shut down, never to open again. Cheaper labor had been found in nearby Massachusetts. Trucks and trains made river traffic less profitable. It was as if someone simply pulled the plug on an era and its community.

Yet that sense of history and community survives today in the town still dominated by these impressive structures. Newmarket's Commercial and Industrial Mill District, consisting of one hundred and forty buildings, is listed on the National Register of Historic Places. The granite mill buildings are the best preserved examples in the state.

Like many old industrial towns, Newmarket is rediscovering its mills. Today, the mill buildings are evolving into much needed housing and

office space for a growing seacoast region. Recreational areas, like this new Heron Point park, attract tourists and residents alike, offering them a view of Newmarket's place in history. Like Northwood Meadows State Park in the Lamprey headwaters, Heron Point represents an exciting new use of the River -- for recreation.

Just down from the stone mill buildings, only a few feet from the center of town, Newmarket offers a unique reminder of its ancient past. Here a private fisherman maintains a "weir" with which he catches fish just as the Native Americans who lived here caught them.

From here the Lamprey River rushes toward the bay, toward Portsmouth and to the sea. Through the seasons and the centuries, the Lamprey River has served people in many ways. Today, as always, we share this river with the wild creatures who also live here. Everyone of us who lives along the river or visits it, helps create the river's future. How the Lamprey changes in our time depends on how we use or abuse the water, the floodplain, and the shore land. Its future is truly in our hands.

Appendix #2

CASE STUDY READINGS

FOR WISWALL DAM AND "WILD AND SCENIC" DESIGNATION

- Report to FERC from John Webster
- "The Lamprey River: A Crown Jewel," The Lamprey River Watershed Association
- Letter from NH Fish & Game on Cocheco Falls Violations
- "Wise Use is a Euphemism for Exploitation," Concord Monitor
- "Wise Use Groups Move to counter Environmentalists," Boston Globe
- Chronology of Events, Wiswall Dam Hydro Project, FERC Project #6632-000
- "What Does 'Wild and Scenic' Mean?" Forest Notes
- The Facts About the Lamprey River Wild and Scenic Study, Lamprey River Watershed Association
- Reprint of the Wildcat River (Jackson, NH) Wild and Scenic Designation
- Summary of Findings on the Lamprey River

More information is available from Judith Spang, Lamprey River Advisory Committee Chair, 659-5936

Federal Energy Regulatory Commission (FERC)
FERC Form 80

Licensed Hydropower Development Recreation Report

ORIGINAL

Form Approved OMB No. 1902-0081 Expires 12 31 92 Burden 3 9 hours

This form collects data on recreational facilities at projects licensed by the Federal Energy Regulatory Commission (Commission) under the Federal Power Act (16 USC 792-825r), and is therefore mandatory. Failure to report may result in criminal fines, civil penalties and other sanctions as provided by law. This form must be submitted by licensees of all projects except those exempted under 18 CFR § 11. (See Glossary Definition Number 2, Exemption). Submit this form on or before April 1, 1991. Submit subsequent filings of this form on or before April 1, every six years thereafter (for example, submit in 1995, 1999, 2007, etc.). Submit to the Commission's Regional Office specified under cover letter to this form, on original, and 3 copies of this form and any attachments for each development within each project. For further information, or an explanation of the instructions, or this form, or additional copies of the form, contact the Commission's Regional Office specified in the cover letter to the form. The public burden for this form is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Please send your comments about this burden estimate, or any other aspect of this collection of information, including suggestions for reducing this burden to the Energy Information Administration, Office of Statistical Standards, EI-73, Mail Station 1H-023, Forrestal, 1000 Independence Avenue SW, Washington, DC 20585, and to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC 20503.

Schedule 1. Public Use Information: Please read the instructions and glossary before completing this form.

1. Instructions:

1.1 All data reported on this form must represent recreational facilities and services located within the development boundary.

1.2 To insure a common understanding of terms, please refer to the Glossary on page 3.

1.3 Report actual data for each item. If actual data are unavailable, then please estimate.

2.1 Licensee Name: JOHN N. WEBSTER

2.11 Licensee No (FERC Use Only): _____

2.12 Type of Project License: (Enter "1" for major projects and "2" for minor projects licensed by the Commission): 2

2.13 Type of Project Operation: (Enter a "1" for projects operating in run-of-river mode, and a "2" for those projects operating in peaking mode): 1

2.2 Project Name: WISWALL DAM

2.21 Project Number: 6632

2.3 Development Name: WISWALL DAM

2.31 Dev No (FERC Use Only): _____

3.1 States Project Traverses (abbreviated): N.H

3.11 State #1: __ (List State(s) with largest to smallest area within the Development boundary)

3.12 State #2: __

3.13 State #3: __

3.2 Name of Stream: LAMPREY

3.21 Name of Drainage Basin: _____

3.3 Reservoir Surface Acres: 14

3.4 Shoreline Miles at Normal Pool Elevation: 2.5

3.5 Name of Nearest City with a Population of 40,000 or More: MANCHESTER

3.51 Distance: From Nearest City to the Dam: 4

3.52 Population of the Nearest City: 10,000

3.6 Estimated Population within 100 mile Radius from the Dam: 250,000

3.7 Pct. of Shoreline Safely Accessible to the General Public by Land Travel without Trespassing: 0 %

3.8 Length of Recreation Season:

3.81 Summer: From (MM/DD): __/__ To: __/__

3.82 Winter: From (MM/DD): __/__ To: __/__

Enter the number of visits to all recreational areas (in Recreation Days) as specified in 4.1/4.2 below (in 1000's).

Period (a)	Number of Recreation Days: Annual Total (1000's) (b)	Number of Recreation Days: Peak Weekend Average (1000's) (c)
4.1 Daytime	0	0
4.2 Nighttime	0	0

For the previous calendar year, enter only the licensee's annual recreational operation and maintenance costs for the development (project). Also enter the corresponding annual revenues in whole dollars.

Item (a)	Licensee's Annual Recreation Costs and Revenues (In Whole Dollars): Operation and Maintenance Costs (b)	Revenues For Calendar Year (c)
5. Dollar Values:	0	0

FERC - DOCKETED APR 4 1991

6. Respondent Certification: The undersigned certifies that he/she has examined the accompanying data; and that to the best of his/her knowledge, information and belief, all historical & estimated data provided herein and appended hereto are true, complete, and accurate.

6.1 Legal Name	6.2 Title	6.3 Area Code/Phone No.
JOHN N. WEBSTER		(207) 384-5334
6.4 Signature	**6.5 Date Signed**	**6.5 Reporting Year Ending**
John N. Webster	3/28/91	1990

Title 18 U.S.C. 1001 makes it a crime for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious or fraudulent statement or misrepresentation as to any matter within its jurisdiction.

BEST COPY AVAILABLE

9104050404

3944-0008

Licensed Hydropower Development Recreation Report

Schedule 2. Inventory of Recreational Resources

7. Enter data for each Recreational Resource Type (a). For Facility Capacity (e), compare the amount of weekend use for this season reported on Schedule 1, Item 3.8, with the facility's capacity to handle such use and enter a percentage that indicates overuse, underuse, or ideal use. Do not consider peak weekend use (see Glossary). For example, if Boat Ramps (Code = 11) are used to half capacity during a non-peak weekend day, enter 50%. For Boat Ramps that are used beyond their capacity, enter the appropriate percentage above 100.

Code = Recreational Resource Type (a)	No. Rec. Resources: User Free (b)	No. Rec. Resources: User Fee (c)	Total Miles/Acres (d)	Facility Capacity (Percent) (e)
10 = Access Areas. (No Facilities) Unimproved but well-known, [illegible] sites which can be used to reach development waters (including waters below a dam) without trespassing on other property. Such waters are used for launching boats, fishing, swimming, or other water recreational purposes	0	0	N/A	0
11 = Boat Ramps. Improved areas having one or more boat launching lanes, and which (a) are usually marked with signs, (b) have compacted gravel or concrete surfaces, and (c) usually have adjacent parking lots			N/A	
12 = Boat Launching Lanes. The area at the boat ramp from which boats may be launched into the development water. The number of lanes at a boat ramp are determined by the number of boats that can be launched safely at the boat ramp at one time			N/A	
13 = Fishing Piers. Structures abutting or extending into development waters which are constructed and maintained specifically for fishing. (This code excludes Code 17 = Tailwater Fishing)			N/A	
14 = Swimming Areas. Sites providing access to development waters where swimming facilities (bath houses, designated swimming areas, parking, and sanitation facilities) are located			Acres	
15 = Marinas. Facilities provided on or adjacent to development waters for the docking, fueling, repair, and storage of boats, and which may rent boats and equipment, or sell bait or food			Acres	
16 = Canoe Portages. Sites located above or below a dam, diversion or other obstruction where persons can launch canoes, and the improved, designated, and maintained trails connecting such sites			Miles	
17 = Tailwater Fishing Facilities. Ramps, walkways, or similar structures to facilitate tailwater fishing			N/A	
18 = White Water Boating. Access areas below a dam that can be used for rafting/kayaking			N/A	
20 = Trails. Improved pathways used for non-automobile recreational travel which (a) can be located on a reference map, and (b) are designated according to type of use (hiking, bridle, trailbikes, snowmobiles, cross-country skiing). This category excludes Code 16 = Canoe Portages.			Miles	
[illegible] = Playground Areas. Have playground equipment, [illegible] courts/fields, jogging [illegible] etc.			Acres	
[illegible] = Picnic Areas. Areas designated and maintained for picnicking and which contain one or more picnic sites, each of which includes a picnic table and in some cases a cooking grill, trash receptacles, and a parking area			Acres	
[illegible] = Camping Areas. (Campsites/Lanes) Areas containing two or more camp sites, tent sites or trailer/recreational vehicle (RV) sites which accommodate overnight camping equipment			Acres	
51 = Tent/Trailer/RV Sites. The total number of sites within Camping Areas (Code = 50) that have been specifically developed for tent, trailer, or RV use. Such sites do not include Group Camps (Code = 57)			Acres	
56 = Organizational Camps. Camping areas that are maintained and operated by a specific entity but which may be used by other persons or groups (scout camps, civilian base recreation camps, church camps, handicapped children's camps)			Acres	
57 = Group Camps. Camping areas which are equipped with facilities to accommodate use by the general public. Such areas usually require registration or advance reservation.			Acres	
60 = Visitor Centers. Facilities located on a kiosk, pavilion or similar structure from which persons may obtain information about the development, its operation, recreational facilities, and related items of interest			Acres	
61 = Parks. Designated areas which usually contain multiple use facilities (picnic sites, playgrounds, swimming beaches, and boat ramps). Individual facilities within each park shall be reported using the appropriate code numbers (e.g. Code 21 = Playground Areas)			Acres	
62 = Wildlife Areas. Natural areas or reserves specifically created and managed for the protection and propagation of wildlife and the viewing of wildlife in their habitat			Acres	
64 = Food Services. Restaurants, grocery, and other facilities supplying food & related services			Acres	
65 = Golf Courses. All types of golf areas, except miniature golf			Acres	
66 = Hunting Areas. Public or private areas open to the general public for hunting purposes			Acres	
67 = Interpretive Displays. Historic or prehistoric objects, structures, sites and areas, including associated facilities (markers and museums) which describe or preserve archeological, historic or prehistoric activities, artifacts and materials			Acres	
80 = Cottage/Cabin Sites. Recreational dwellings which are seasonally rented by the public for recreational purposes			N/A	
82 = Overlooks. Public areas to see natural areas/project features (e.g., overlooks, vistas, etc.)			Acres	
84 = Winter Sports. Any facility providing sports like skiing, sledding, ice skating or ice fishing			N/A	
99 = Other (Specify):			N/A	
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3445 8888

THE LAMPREY RIVER: A "CROWN JEWEL"

The river described below is clearly a resource to be treasured, not only for the towns and region concerned, but for the future population of a growing nation. The Lamprey is currently threatened by a license issued for hydroelectric generation at the Wiswall dam in Durham. The Towns of Durham and Lee, as well as the Governor of New Hampshire, are seeking to protect the Lamprey through the National Wild and Scenic Rivers Act.

GEOGRAPHICAL LOCATION

The Lamprey River is located in the central and eastern New Hampshire Seacoast areas. It is over 60 miles long, flowing from Lake Pawtuckaway to the Great Bay, which in turn empties into the Atlantic Ocean at Portsmouth. In fact, the Lamprey is a major tributary of the environmentally-sensitive Great Bay. (Great Bay has just been designated a part of the National Estuarine Research Reserve System, a significant federal effort to preserve a water body of national importance.)

In 1990, the 9.5 mile Durham-Lee segment of the Lamprey became one of only five river segments designated by the Legislature to the New Hampshire State Rivers Management and Protection Program, based on its "outstanding statewide and local resource values and characteristics". The evaluation included both resource analysis and assessment of community support for river conservation. However, this State program is powerless to protect the river as intended if federal projects are approved which destroy the very values for which the river was selected.

HISTORY OF TOWN COMMITMENT TO THE RIVER'S PROTECTION

The portion of the Lamprey proposed for protection is an approximately 9.5 mile stretch from the Lee-Epping border through the towns of Lee and Durham to the Newmarket border. **In 1982, the National Parks Service studied the river segment and placed this portion of the Lamprey on the national inventory of Potential Wild and Scenic Rivers.**

In 1984, the Strafford Regional Planning Commission prepared a River Management Plan for the Lamprey. This effort included preparing annotated maps of the river, with potential recreation areas, public access points, scenic areas, potential sources of pollution and historic landmarks.

An outgrowth of this effort was the formation of the Lamprey River Watershed Association, the organization taking a lead role in coordinating the Wild and Scenic Rivers efforts. The LRWA has also conducted water quality monitoring programs on the river, produced a well-respected handbook on river water quality monitoring for lay people, and brought together river towns in discussing issues relating to the Lamprey.

In 1988, the Ad Hoc Committee on Conservation Lands, representing Conservation Commissions from Lee, Durham, Madbury and Newmarket, along with the University of New Hampshire, designated the Lamprey River Corridor as one of six prime areas for concentrated conservation efforts in the region.

Both Lee and Durham are environmentally conscious towns. They have comparable Wetland Protection, Shoreland Protection and Aquifer Protection ordinances in place to preserve both water quality and scenic value of the river. Conservationists in both towns have also been active in soliciting a growing number of landowners interested in selling or donating easements along the Lamprey.

Further efforts are supported by Town policy: goals of the 1989 Durham Masterplan include: "maintain and acquire green belts along both the Oyster and Lamprey Rivers for use as a trail system, where appropriate"; and "Establish a watershed overlay protection zone along rivers serving as existing and potential domestic water supply." The latter refers to the Lamprey, which is also part of Newmarket's back-up water system downstream.

Minimum lot sizes along the Lamprey are two and three acres at present. Cluster ordinances have allowed for the preservation of shoreland for common use. Fortunately, development along the river to date has either availed itself of this option, or has been characterized by a few large lots with houses set well back from the river.

However, most of the land is still open: there are twelve active or inactive farms with between a half-mile and a mile of riverfrontage. In Lee, eight properties account for 7.8 miles of frontage. This is indeed remarkable, given that the river is located less than 15 miles from the crowded Seacoast area, and only 60 miles from Boston.

Support for the Wild and Scenic study designation is strong: seventy-five percent of the riparian landowners in Durham and Lee have petitioned to have the study done. The town governments of both towns, the N.H. State Department of Environmental Services, the Office of State Planning, the University of New Hampshire (a riparian landowner) and the Governor have also endorsed the Wild and Scenic study for this river segment.

FISHERIES AND RECREATION

In a 1983 study prepared by the New England Rivers Center, the Lamprey River was recognized as "the state's most significant river for (non-salmon/shad) anadromous (fish) species." (This was before the river became part of the salmon/shad restoration program.) Native (naturally reproducing) fish species sought by fishermen include small and large-mouth bass, chain pickerel and brown bullhead. In addition, in a program to restore certain species, the N.H. Fish and Game Department are stocking rainbow, brown and brook trout, shad and (in a new program this fall) Chinook salmon.

A 1985 survey conducted by that Department found that anglers spent 875 fishing-hours on a 3/4 mile stretch of river from Wiswall Falls to Packers Falls in a single month. Fishing is heaviest at the Wiswall dam and at Packers Falls. Fishing continues into the winter, with ice-fishing popular the length of the river.

The river is heavily used for recreation by residents of the entire Seacoast area. Fishing and canoing bring enthusiasts from throughout New England. Public access for fishing is largely informal, with Salmon Unlimited negotiating agreements with private property owners in key areas.

Commonly-used informal canoe launching areas provide access to 36 miles of river, starting in Deerfield and ending at the dam in Newmarket. The AMC River Guide (pg. 216 and 217) describe the Lamprey in Lee thusly: "a long, smooth stretch twists through old pastures and woods for another 5 miles past the mouth of the North River to Wadley (sic) falls." Below Wadleigh falls:" For a quiet retreat into the woods, the first 4 miles are superb... 4 miles of quiet paddling past densely forested banks of hemlocks and hardwoods to the Lee Hood Road bridge."

For more adventurous canoeists and kayakers, the AMC Guide recommends Durham's Packers Falls recreation area, which provides "one of the most challenging rapids on the Piscataqua Watershed. It is a roaring Class III run in early spring, and it is often run well into the summer as a Class II drop. There are well-developed portage trails for those who want to run Packers Falls several times."

Winter brings skaters, skiers and ice fishermen. Local skimobile clubs have negotiated with private landowners in building a trail which crosses and re-crosses the river for miles. This trail is also enjoyed by cross-country skiers.

Town-owned recreation areas on the Lamprey are heavily used by residents of towns as far away as Portsmouth. They include the Wiswall Road area where swimming, canoing, fishing, picnicking, horseback riding, skating and skiing occur on both the Town land and, by consent of the abutting landowner, on adjoining riverfront trails. At Durham's Packers Falls Recreation Area (cited above), dozens of swimmers and tubers are seen at the falls throughout the day. Parking is provided.

Durham also owns the 80-acre Doe Farm, with extensive hiking and skiing trails and 750 feet of riverfrontage. Across from the Doe Farm on privately held land are a traditional town swimming hole and 7500 feet of trails along the river used by walkers and horseback riders. All these areas are within the proposed river segment.

WILDLIFE HABITAT

Like most natural riverine environments, the Lamprey offers a rich habitat for wildlife. The shoreland offers a mixture of extensive corn and hay fields, undisturbed woodlands hundreds of acres in size, and large wetland areas (almost 1,000 acres in Lee alone), including beaver marshes. This diversity creates an especially rich habitat for wildlife. One Audubon Society observer has noted 140 species of birds, half of which are suspected of nesting in the Lamprey corridor. Osprey, young eagles and heron have been sighted with increasing frequency on the river. The river is being recognized as an important extension of the Great Bay wildlife habitat.

The Fish and Game Department have cited 26 species of commonly-seen mammals, including otter, beaver, mink, coyote, red fox and fisher. Moose and signs of black bear have also been reported. (The Watershed Association has recently compiled a detailed inventory of wildlife species found in the river corridor.)

In all, there are 27 State Imperiled or Rare species of mammals, reptiles, amphibians, and birds in the Durham/ Lee Lamprey corridor, five of which are Critically Imperiled.

Especially vulnerable to alteration in water levels are the 85 species of vegetation along the river, 12 of which are State Rare or Endangered plants. The extensive river wetlands also serve as flood storage and filtration for lower Lamprey communities, two of which are tapped into the Lamprey as a secondary public water supply.

HISTORICAL SITES

The historical significance of the Lamprey is alone sufficient to warrant its consideration under the Wild and Scenic Rivers Act. In 1987, the Wiswall Falls Mill Site was placed on the National Register of Historic Places due to the remains of a very extensive 19th century mill complex. Archeological digs have revealed promising areas for very early Indian finds in the vicinity, as well.

Farther upstream in Lee, at Wadleigh Falls, Professor Charles Bolian has documented an important Indian site over 8,500 years old. This site could also be compromised by any hydroelectric development at the Wadleigh Falls overlooking it. (The Watershed Association has assembled the reports prepared on these two sites.)

WATER QUALITY

The Lamprey River is currently a Class B river, suitable for swimming, fishing and other recreational uses. Non-point source pollution from tributaries is seen as a clear threat to Great Bay's shellfishing industry and to its function as a nursery for finfish harvested the length of the Eastern seaboard. Consequently, scientists at the Jackson Estuarine Laboratory have petitioned for the Lamprey to be protected both by local zoning and by the national Wild and Scenic program because of its significant impact upon the federally-protected Great Bay.

Time is a critical factor in saving the Lamprey River. A license to construct a hydroelectric facility at the Wiswall dam was issued on June 17, 1989. The developer has stated that he will immediately amend his license to provide for 2-foot flashboards -- a procedure which allows the circumvention of an Environmental Impact Statement on this fragile ecosystem, which is also such a social resource.

Several appeals and formal objections have been filed to the license by private parties, the Towns of Durham and Lee, and the N.H. Attorney General. While these are unresolved, the door is open for Wild and Scenic designation of the Lamprey River. Once appeals are exhausted, the opportunity to save the Lamprey is lost forever.

More information may be obtained by contacting:
THE LAMPREY RIVER WATERSHED ASSOCIATION
Richard Lord, President
Bennett Road, Durham, N.H. 03824
Tel. (603) 659-2721

State of New Hampshire
Fish and Game Department

2 Hazen Drive, Concord, NH 03301
(603) 271-3421

Donald A. Normandeau, Ph.D.
Executive Director

June 26, 1989

Mark Robinson
Office of Hydropower Licensing
Division of Project Compliance
and Administration
825 North Capital St. N.E.
Washington DC 20426

REF. NH Dam #67.04
Cocheco Falls Dam
Cocheco River
Dover NH
FERC #4718

Dear Mr. Robinson:

On December 8, 1982 your commission issued a Minor License for the above hydro project. Article 23 of the License states that the Licensee "consult and cooperate with the NH Fish and Game Department...for the construction of new facilities...that would permit downstream passage of anadromous fish". This department's recommendation for downstream fish passage call for one inch clear spacing of the trash racks, approach velocities which do not exceed one foot per second, and a downstream migrant sluiceway at the north end of the spillway which will accommodate flows of 20 CFS.

On May 5, 1986 this department wrote the Licensee and informed him that the modifications to the trashracks had not been undertaken as the actual spacing is 1-3/4 inches. Also, the department pointed out that the sluiceway is regularly clogged with debris. Further the department recommended that he correct the problem.

On November 16, 1988 I wrote you describing complaints this department had received regarding dead fish, specifically juvenile alewives and American eels which had been entrained and killed as a result of the operation of the hydro facility. I also pointed out in that letter that the reason for the mortalities were that the spacing of the trashracks had not been reduced and the sluiceway pipe was inoperable for periods of up to a week due to lack of maintenance.

This department is disturbed with the lack of compliance by the Licensee particularly since we have been actively involved in restoring the runs of anadromous fish to the Cocheco River since 1972 when this department funded the construction of fish ladder at the existing Cocheco Falls Dam. The restoration efforts have been somewhat successful in that this spring over 17,000 adult alewives ascended the ladder to upstream spawning areas, however the restoration could be negated if the Licensee does not comply with Article 23.

As I stated in the November 16, 1988 letter the management efforts of Fish and Game Department cannot succeed unless the conditions of the License are strictly adhered to. I also recommend that if compliance is not met by July 1st of this year that your commission order the Licensee to cease hydro operations until full compliance is reached and accepted by this department.

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As of this date nothing has been undertaken at the hydro facility as required by Article 23. Since the downstream migration of adult and juvenile alewives will begin in July it is important that your commission act promptly to assure the protection of these anadromous fishery resources.

If you have any questions please contact Fisheries and Wildlife Ecologist, William Ingham, Jr. at (603) 271-2501.

Sincerely

Donald A. Normandeau, Ph.D.
Executive Director

DAN/WCI

enclosures

cc: William Ingham, Jr.
Gordon Beckett
John Nelson

Concord Monitor, 4/20/92

Wise Use is a euphemism for exploitation

Environmentalists must stand firm

By SYLVIA BATES
For The Monitor

Monitor Forum
Board of contributors

> ...It is rare we regret environmental action; too frequently we regret inaction.

"You can't tell me what to do with my land — I have rights!"

This statement is the credo of the so-called Wise Use movement, a pro-industry, pro-development coalition of property rights activists with roots in the Pacific Northwest. The movement is a national trend alarming the environmental community with its misinformation, misrepresentation and misunderstanding regarding sound conservation policy.

Bates

Perhaps a product of the Reagan-Bush administration and the boom time of the 1980s, the heart of the Wise Use movement seems to be nestled in greed. Its political ideology is based on shortsightedness, egocentrism and avarice. Supporters object to land use regulation and public land ownership, such as national parks. Some groups do not shun violence and employ militant tactics to make their point. And they have singled out environmental organizations and public conservation agencies as their worst enemies.

In New Hampshire, the Wise Use movement has manifested itself in such groups as the Camp-based Land Owners Alliance. These groups are not only fighting the Northern Forest Lands Council designation, but they are also active on the local level, undermining zoning regulations.

Their arguments for anti-regulation and strong property rights range from the economic to the emotional. But their consistent failure to see responsible stewardship of the land as an obligation that goes along with the privilege of land ownership defeats their rhetoric.

The property rights activists' misuse of the term "wise use" is an affront to the founders of the conservation movement nationally and in New Hampshire.

Aldo Leopold, the father of conservation, wrote: "We abuse land because we regard it as a commodity belonging to us." Leopold was a staunch proponent of multiple use in the genuine sense of those words. He advocated prudent management of the land along with a careful use of its natural resources to preserve them for future generations. For Leopold — and for most landowners — unchecked, exploitative use of the land does not constitute "wise use."

The environmental movement in New Hampshire was founded at the turn of the century with the support of conservative business leaders. They were firm believers in individual property rights, but they also recognized the need for long-term resource protection.

The passage of the 1911 Weeks Act, which created the White Mountain National Forest, is a story of activism by a coalition of diverse interests — hotel owners, manufacturers, timber companies, conservation groups and political leaders — who were fighting short-sighted timber destruction in the White Mountains.

Concerns centered on destroyed scenic vistas, fewer summer visitors, land monopolies and more forest fires. None of these was the crucial factor. That came when soil erosion dried up watersheds, causing a loss of the river waterpower needed to run mills many miles to the south.

This ultimately caught the attention of legislators. It became clear that creating a public forest reserve would not only protect the mountains but also would help ensure the integrity of the water and timber resources for all.

Property-rights activists must realize that private land ownership is not a closed system. What a landowner does with his or her land is a choice that affects adjoining properties, the community at large and future inhabitants. Just as toxic chemicals discharged upstream will eventually flow downstream, so too will unsightly and poorly planned development impact an entire community. Land use and environmental regulations protect the resource and protect the landowner from himself and his neighbors.

Most people are intelligent enough to recognize the rhetoric of these property-rights activists for what it is. What possible motive could proponents of sound conservation policy — most of whom are endless hours trying to "take away rights?"

But that misconception is out there, and environmentalists have to do a better job of reminding people why we do what we do: Our role is to promote sound public policy to protect natural resources for the public good — not to control or subvert individual rights.

It is time for the environmental community to stop pandering to property-right activists. Strict environmental regulation and responsible stewardship of the land are necessary to protect resources. That may be tough for everyone to swallow in the real world of short-term outlooks, quick profits and self-interest, but sometimes we have to make tough choices and look beyond the immediate gain. It is rare that we regret environmental action; all too frequently we regret inaction.

The conservation movement is grounded in good economic sense, good political sense and good generational sense. There's no need to be timid about our commitment to advocate strong environmental regulation to protect our natural resources, now and into the future.

(Sylvia Bates, a member of the Monitor's board of contributors, is a land protection specialist with the Society for the Protection of New Hampshire Forests and chairwoman of the Concord Conservation Trust.)

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The Boston Globe

TUESDAY, OCTOBER 20, 1992

'Wise use' groups move to counter environmentalists

By Scott Allen
GLOBE STAFF

CAMPTON, N.H. – Some people wear their [illegible]s on their sleeves, but Tony Yeskis put his on [illegible]ide of his painting truck. In beautiful, hand-[illegible]nted letters, the sign reads:

"Eco-Fascists: Green on the Outside, Red on the Inside."

Yeskis despises environmentalists, a group he considers urban elitists bent on turning rural America into a park. Holding forth at the Mad River Tavern in this tiny town south of the Waterville Valley ski resort, he blames environmentalists for everything from industrial decline to the red tape he had to go through before paving his driveway.

"What is a future generation going to do with a

ALLIANCE, Page 20

Cheryl Johnson, Tony Yeskis and the van that spells out their alliance's po

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'Wise use' groups organize t

■ ALLIANCE
Continued from Page 1

pristine planet when man has no freedom of movement and can't do anything?" asked Yeskis, a leader of the New Hampshire Landowners' Alliance.

The Alliance is part of the "wise use movement," an antienvironmentalist campaign that began in the Pacific Northwest and is sweeping across New England. There are now at least 10 "wise use" groups in this region, including Friends of the Rivers in Massachusetts.

Each group pursues its own local agenda, but most are heavily influenced by the national network of "wise use" organizations and literature. "Wise use" founder Ron Arnold of Seattle, whose stated goal is to "destroy" the environmental movement, has visited the Northeast repeatedly, most recently to attend a regional wise use conference in South Portland, Maine, last month.

The movement even has its own songs, such as "I'm a Tree" ("It's alright to cut me down, just use me wisely"), as well as a new book that argues environmentalism is a cult involving a belief in elves and fairies.

"Wise users" charge that the environmental crisis has been largely trumped up as an excuse to take control of the nation's natural resources. They oppose public ownership of land and environmental protection for rivers, while vigorously supporting more timber harvesting in national forests.

In their attacks, leaders of the movement often engage in the kind of red-baiting tactics of Yeskis' truck sign. Arnold calls environmentalism "the third great wave of messianism to hit the planet, after Christianity and Marxism-Leninism."

Stewart Udall, a former congressman and secretary of the interior, suggests that environmentalists have become the far right's substitute for communism since the collapse of the Soviet Union.

But the wise use movement is more than a front for right wing ideologues. Its arrival in New England is in part a backlash against environmentalists' increasing success in protecting natural resources from development in rural areas.

One of the region's first wise use activists, Leon Favreau, runs a family furniture parts business in Bethel, Maine. He sees efforts to restrict logging in the White Mountain National Forest as a direct threat to his supply of lumber.

"There's no question the Wilderness Society, the Sierra Club and others want to put us out of business," said Favreau, who founded the Multiple Use Association in 1988 to fight back. Today, 300 of the 500 members are forest-products companies, and the Wood Products Manufacturers Association gave him $2,500 to help pay for the conferen in Maine last month.

Fear of land grabs

Wise use attacks have found f tile ground in rural areas wh there has long been suspicion t the US government, pushed by er ronmentalists, plans to take m private property. The Washing County Alliance in Maine, for ex ple, was formed after an envir mental group suggested that m of the privately owned coastl there would make a good natic park.

"People don't want to sell t land. Some of it's been in their f ilies for 200 years," said Bob Voi president of the Maine Conserva Rights Institute, perhaps New E land's most prosperous wise group.

Preying on fears about l grabs, the movement has made roads in all the New England st except Rhode Island:

■ In central New Hampshi tourist region, the Landowners' ance is fighting a National Park vice proposal that would ban fu dams and water diversions along Pemigewasset River. "There is ture agenda of making this ar playground," said Alliance presi Cheryl Johnson. Park Service cials have promised not to take private property to protect the r

■ In western Massachus wise use activists were able to federal protection of the Farmin River after passing out handbil people living along the river that declared, "Your Land Has Stolen!!" Despite federal assura the towns of Otis, Sandisfield

target environmentalists

and promptly voted to drop out
ve protection program.

On the other hand, wise use
egist Eric Veyhl of Concord
! in his attempt to stop the Park
ce from studying the Concord
· for additional parkland. How-
one official from a private con-
ation group said Veyhl has
ed land sales to private preser-
n groups.

Officials at the Massachusetts
h Buggy Association, which is
ng to allow more off-road vehi-
on the state's beaches, say the
iation should be considered a
use group even though it is not
ally connected to the move-
. Vice president Lloyd Plasse
he agrees that many environ-
alists are "a bunch of whacked
Chicken Littles. They border on
: Nazis."

In Maine, a raucous demon-
ion in Bangor in 1991 persuaded
ate's US senators to scale back
ly of ways to protect 26 million
of forestland in northern New
and. The Maine Conservation
ts Institute, the lead group
g at least 18 wise use groups
wing the study, expected to
· $294,163 in donations and
ts by the end of 1992.

At Vermont's Killington Ski
rt last June, the Citizens for
erty Rights hung 20 political
rs in effigy, including Demo-
c Gov. Howard Dean, saying
were a threat to private proper-
ghts. Though the group is not
ally connected to national "wise
groups, its goals – weakening
and federal environmental laws
· similar.

■ In Connecticut, Friends of the River unsuccessfully fought federal protections for the section of the Farmington that flows in that state. All five towns along the river voted to accept the ban on dams and water diversions.

"An ongoing struggle"

The movement remains on the political fringes – only 60 people attended the Maine convention – but New England environmentalists are taking it seriously.

"Combining noisy demonstrations with quiet organizing and coalition building, wise use organizers have rapidly made themselves important factors in an ongoing struggle to shape the region's economic and ecological future," warns a report prepared for a private group involved in land preservation.

The national march of the movement has been especially alarming to groups such as the Nature Conservancy, a low-key organization that relies on public good will to acquire land and then, frequently, turns it over to government agencies for preservation. The wise use movement has accused the Conservancy of being a puppet for the federal government and has persuaded the Interior Department to investigate the group.

"Their aim is to plant mistrust in the very people the Conservancy must work with as partners in our preservation projects," wrote Conservancy president John C. Sawhill in an August fund-raising appeal.

But wise users say that, if the public would look beyond the environmentalists' smear campaign against them, it would see that wise use makes sense.

Many rural people make their living from the forests, rivers and other natural resources, explained Favreau, president of the Multiple Use Association. His 70 employees rely on a steady supply of maple trees to turn into parts for furniture and pianos.

Debate and disruption

Beneath the sometimes-bizarre trappings, the movement raises valid issues about protecting property rights and about environmentalists' exaggerations, says Bill Burke, who wrote the report on New England wise use groups for Political Research Associates, a Cambridge-based group that monitors right-wing activity. The report was paid for by an unnamed group.

The trouble is that the movement's extreme tactics polarize debates and attract extremists, he adds. Supporters of the John Birch Society and political extremist Lyndon LaRouche passed out literature at a 1991 wise use rally in Maine.

Burke also believes that wise use activists intentionally disrupt debate on the issues. The New Hampshire Landowners Alliance bought 500 copies of the Record Citizen in Plymouth in an effort to keep people from getting a questionnaire on protection for the Pemigewasset River.

"The wise use/property rights movement is dedicated to preventing such open, fair debate. Intimidation and misinformation are not the basis of a free society," said Burke.

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CHRONOLOGY OF EVENTS

WISWALL DAM HYDRO PROJECT
FERC PROJECT #6632-000

May , 1982: John Webster files application with FERC to develop the Wiswall Dam on the Lamprey River, Durham, NH.

October, 1984: The flash board controversy begins with Webster sending a letter to Bob Bell, FERC Project Manager, demanding that flash boards be considered as part of his application. Webster states that he intended to use two-foot high flash boards from the beginning.

November 3, 1984: Webster receives letter from Quentin A. Edson (Director, Office of Hydropower Licensing, FERC) stating that an amended application to add the use of flash boards would make the application "untimely" and result in rejection. Webster subsequently drops any reference to flash boards in his correspondence with FERC.

July, 1985: In a letter to George Crombie, Director of Public works for Durham, Webster states that he intends to use flash boards.

May, 1986: New Hampshire Fish and Game writes Webster, complaining that his Cocheco Falls operation is out of compliance.

October 17, 1987: William Diehl, FERC Design Review Engineer, recommends that the project be rejected by FERC because it is not economically feasible. In his recommendation, Diehl sites the disagreement between FERC and Webster on flow, head height, and fish ladder construction costs.
After Diehl's memo, Webster wrote FERC on 9/28/99 with new information about the project:
- average flow was increased from 320 cfs to 380 cfs
- output was now based on a 14 foot head
- 30 cfs was used for flow into the bypassed area
- fishladder costs were increased from $42,000 to $80,000

April, 1988: FERC Project Manager informs Carl Spang that Project #6632 will most likely be rejected because it was not economically feasible. A letter from Lawrence Anderson (Director, Office of Hydropower Regulation), written on 6/13/84, and stating that a fish ladder would cause Webster's project to become economically infeasible, is given as evidence. (Webster is required by FERC to install a fish ladder.)

November, 1988: NH fish and Game writes to FERC complaining of continuing violations at Webster's Cocheco Falls operations.

June 1989: FERC's order issuing license to project #6632 becomes law. The town of Durham, the Town of Lee, Carl Spang, the attorney General of New Hampshire, and several other individuals send appeals to FERC, asking that the license be recinded. Both Lee and Durham town governments unanimously vote to appeal the license and pursue Wild and Scenic status for the Lamprey.

What does **Wild & Scenic** mean?

The study process

The Wild & Scenic Act of 1968 was intended to balance damming and diversion projects by conserving the free flowing quality of especially valuable rivers. There are 130 rivers in the system; each new designation requires specific legislation defining the particular goals and methods of protection. Currently, Wildcat Brook in Jackson is New Hampshire's only Wild & Scenic River. The Pemigewasset, the Merrimack, and the Lamprey Rivers are being studied.

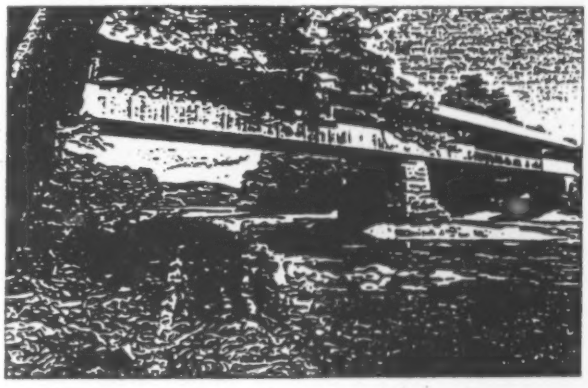
To be considered for designation, a river must be "eligible" (free flowing and possessing one or more outstanding resources) and "suitable" (long-term protection ensured by local, state, and private entities, and strong public support.) At the suggestion of the Pemi River Council, the Pemi study was requested by selectmen from seven towns: Thornton, Campton, Holderness, Plymouth, Ashland, Bridgewater, and New Hampton. It also covers the river from its source at Profile Lake in Franconia Notch State Park south to the park boundary.

The purpose of the study is to assist local communities in determining how best to conserve the river's special qualities; and to determine whether the study segments should be designated Wild & Scenic.

Guided by a local committee of diverse interests, the study is coordinated by the National Park Service. Technical assistance comes from several private and public organizations, including the Office of State Planning, Merrimack River Watershed Council, regional planning commissions, and the Forest Society, which is providing education on voluntary land protection agreements.

The study committee started by setting goals and objectives, and is currently working on a comprehensive resource evaluation and management plan. Based on this information, a series of recommended private, local, and state actions will be developed. At that point, the committee will vote whether to recommend that the towns approve Wild & Scenic designation as a way to help implement these steps. If the committee approves, the question will be put to residents at Town Meetings. Some or all towns can be included in the recommendations to Congress. US Senator Bob Smith and Representatives Dick Swett and Bill Zeliff have all said they would introduce a designation bill only with strong local support. Any town that votes no will be excluded.

Even if the river is not designated (more studies end up without designation than with it) the communities will have benefitted from an influx of federal planning money and technical assistance; better understanding of the river's many resources; sophisticated maps of land uses, sensitive areas, and other features; related "by products" like the design of Plymouth's new riverside park; a comprehensive report on the various levels and effectiveness of town regulations; a management plan that can be used, filed, revised, or thrown out altogether by each town as it sees fit; and the experience of having a group of residents discussing the future of their river.



What about designation?

If the river is designated, the communities will have all the above, plus continued funding and technical assistance, and permanent prohibition against federally funded projects such as dams, Army Corps projects, highways, and stream diversions. In addition, Wild & Scenic would likely increase land values along the river, and provide expanded tourism opportunities (if towns decide to promote it.)

All land use decisions remain in private hands, subject only to local and state regulation, just as they are now. In five of the seven towns, no change in local regulations will be necessary. In Bridgewater and Thornton, local zoning would have to be revised.

The federal government is given no authority to zone or control land, and the Pemi bill can be written to limit or prohibit land acquisition. Landowners would be under no obligation to provide more access or otherwise change the way they currently manage their properties. (Indeed, the Merrimack River study committee has discussed proposing agriculture as a protected use, guaranteeing that farmers could not be driven out by "snob" zoning or other local restrictions.) *RO*

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The Facts About the Lamprey Wild and Scenic Study

Published by the Lamprey River Watershed Association July 1993

Some Questions and Answers about the Wild and Scenic Program

Dear Members and Friends of the Lamprey River Watershed Association:

At our Spring Meeting, we had a speaker who discussed the Wild and Scenic Program, and the experiences of the towns and landowners involved in the Pemigewasset study.

We were told that a group called the New Hampshire Landowners Alliance, which is part of a national organization called the Alliance for America, had used some very strong tactics to oppose the Wild and Scenic Program. These tactics included newspaper articles and advertisements with misleading information, disruption of meetings, and confrontations with local officials. It was a tragic story, and not one that we want repeated here.

At the end of the meeting, the LRWA was asked to research and distribute a simple explanation of the Lamprey's Wild and Scenic process, so that our members would have the facts in hand when the Alliance came to the Lamprey. As predicted, in the meantime, misinformation has begun to appear in recent newspaper articles about the Wild and Scenic Program and the proposed Wiswall Dam hydro facility

I believe that the following information should answer the basic questions raised about the Wild and Scenic process. But if there are more, please call or write. We will be happy to continue these mailings so that everyone stays informed.

Regards,

Carl Spang

1992 - 1993 LRWA President

1. What is the National Wild and Scenic Rivers Program?

The National Wild and Scenic Rivers Program is a river conservation program. It was created to offer certain selected rivers protection from Federally-licensed projects which might destroy them.

Prior to the Wild and Scenic Rivers Program, there were a growing number of dams, major water diversions, and hydroelectric projects approved or constructed by Federal agencies over the objections of local people, including those who lived along the rivers, local farmers, and recreational users.

The Wild and Scenic Rivers Act was passed by Congress in 1968 to protect rivers designated as "outstandingly remarkable" from such projects. In many cases, it has been used to prevent inappropriate hydroelectric developments.

Contents include

1 How does the Wild and Scenic Program Work
2 Who is involved
3 What Landowners and Recreational Users should know
4 Some facts about the hydro license on the Wiswall Dam
5 What the Jackson, NH, Wild and Scenic bill looks like

Why should a Lamprey River landowner or recreational user be interested in Wild and Scenic? The Wild and Scenic River Program can give property owners and recreational users greater ability to protect a river. Under the program, the local and state laws currently in place become part of a river program supported rather than circumvented by the Federal Government. For example, today the rights of Lamprey towns, landowners, and recreational users are in conflict with a proposed hydroelectric facility at the Wiswall Dam location. Once in operation, the operator would have:

-the deeded right to use flashboards and raise the level of the Lamprey by two feet.

-the right to obtain property now owned by the Town of Durham through eminent domain.

-the water rights for 7000 feet (approx. 1 1/2 miles) up-river of Wiswall Dam, which is now part of Durham's water supply.

The license was granted without any public hearings or environmental impact studies. It was unsuccessfully opposed by the Towns of Durham, Lee, the State of New Hampshire, and Lamprey landowners. Once in place, the operation will be exempt from local or state laws. The license is temporarily suspended during the Wild and Scenic study, and would be rescinded if the Lamprey receives Wild and Scenic designation.

This scenario could repeat itself many times as competition for Lamprey resources increases in the future. The Wild and Scenic Act would ensure that the Federal Government does not in the future violate our local desires to sensibly manage and conserve the Lamprey.

3. How does the National Wild and Scenic Rivers Program work? Who is involved? A river is designated Wild and Scenic by Congress. But before Congress will vote to designate a river, the following steps must be accomplished.

1. The segment should be listed in the 1982 Nationwide Rivers Inventory of potential Wild & Scenic Rivers, a listing of rivers that are considered to be America's highest quality rivers. *This step is optional, but the Lamprey River segment in Durham and Lee was listed in this inventory.*

2. The landowners, town governments and state government must request -- through their Congressional delegates -- that Congress enact a Wild and Scenic Study bill to evaluate a river segment for eligibility. *This was done and in 1991, the New Hampshire Congressional delegation successfully petitioned Congress to pass the Lamprey River Wild and Scenic Study Bill.*

3. The National Parks Service, working with a local committee, conducts a study of the river characteristics - wildlife, scenic quality, recreation, water quality, vegetation, historic or archeological significance - and works with landowners and local officials to develop a River Management Plan. The River Management Plan outlines what aspects of the river are special, which ones the towns want to protect, and how they can be protected. *This is underway, with a committee of people from Lee, Durham, Epping and Newmarket meeting monthly. The work will be completed in 1994.*

4. The National Parks Service reviews the study to determine if the river segment supports natural cultural or recreational values which warrant Wild and Scenic designation.

5. Study findings, the river plan and any proposed Congressional bill based upn the river plan will then be submitted to the four towns (Durham, Lee, Epping, and Newmarket) for review and comment. Reviews will occur through public meetings. *The Lamprey River Watershed Association will mail this material to members, riverfront landowners, and any others who request it.*

6. A formal vote is then taken in each of the towns in the segment on whether to support the River Management Plan and the Wild and Scenic designation.

7. The National Parks Service will only recommend designation of the river in towns which formally vote to support it. If the Towns vote "yes," then the local

advisory committee, local officals, state officials, and the National Parks Service will finalize the bill and request that Congress enact this statement into law by amending the National Wild and Scenic Rivers Act to include the Lamprey.

4. What is the schedule of events for the study and designation? The study is underway and will be completed in 1994. Activities currentlly include: a landowner survey of goals for the river; wildlife inventory; recreational user survey; and a review of existing river-related regulations.

Although the final schedule has not been set, it is expected that Towns will vote in 1995.

5. What will the river management recommendations look like? The recommendations will have several parts to them:

- Steps we need to take to protect important qualities of the river. (It is nice to know that our local and state ordinances already do a great job).

-The roles the local, state, and Federal agencies will each play in protecting the river. At this stage, towns and landowners can decide upon the degree of Federal involvement. We will all have a chance to read them, discuss them, make changes to them.....and, if we still don't like it, vote against them at the Town meeting. *Because Durham and Lee have had comprehensive shoreland zoning regulations in place for years, it is expected that there will be few changes recommended to the existing zoning.*

6. What will the proposed Wild and Scenic Bill for the Lamprey look like? Each river has a custom-tailored bill. The Lamprey bill could be very similar to that of Jackson, NH (attached).

7. Will the Wild and Scenic designation force me to leave my land? NO! The objective is to protect and enhance the river's resources while maintaining local control of land and activities. The National Parks Service supports towns which want their Wild and Scenic Bill to *prohibit involuntary sales of land.* The issue of *voluntary* sales must be worked out by the towns. For example, some conservation-minded property owners may want to have federal funds available so they could sell land or easements along the river. Others may fear *any* federal role and would want to strictly prohibit even voluntary sales. Ultimately, this part of the Wild and Scenic Bill must be decided through a process of public hearings and town vote.

8. Will all new development be banned? No. As long as the proposed development meets the requirements of local and state regulations, and will not degrade the river, it will be allowed. The National Parks Service will only review federal actions.

9. Will the Federal Government zone riverfront land? No. The Wild and Scenic Rivers Act does not give the Federal Government the power to zone private land. Land use controls on private land are *only done by state and local government.*

10. What protection does the Wild and Scenic Program provide the Lamprey? There are three ways that the Wild and Scenic Program protects a river:

1) Any permit issued by the federal government which might impact the river must be examined to see if the activity will degrade an attribute of the river found to be of special significance. In many cases, permits for even large-scale projects can be granted if they are designed to minimize any negative impact on the river.

2) The River Management Plan put together by the Local Advisory Committee and approved by the towns, forms a part of the Wild and Scenic Bill. No federal agency can issue a permit that would violate the goals of the plan.

11. As a citizen or land owner, will I have some say over what river management plan is adopted? Yes. The planning process requires surveys and public meetings. As local governments will be responsible for continuous river management planning, citizens and landowners will always have a say in the planning process.

12. Are special provisions ever part of a Wild and Scenic River

designation bill which protect the land owners? Yes. See the copy of the Jackson, NH, bill as an example of limiting the powers of the Federal Government.

13. How does designation impact land values? Landowners can benefit. Two studies - one for the Upper Delaware in New York and Pennsylvania and one for the Rogue River in Oregon - show that land values are very positively affected by designation.

14. Why all the fuss about Wild and Scenic? On a national level, the Wild and Scenic program has come under fire by groups supporting commercial developments in National Parks and Refuges. Commercial interests supporting hydro, mining, and timbering may oppose the Wild and Scenic designation because it eliminates a way to bypass local and state regulations.

Some companies are rumored to have enlisted the support of lobbying groups who portray themselves as local property right advocates, or alliances, to discourage local interest in the Wild and Scenic program. Many of these alliances receive national funding to publish newsletters and run advertisements urging opposition to the program.

Some Facts about the Proposed Hydroelectric Project on the Lamprey River

History: In 1982 John N. Webster, Southern New Hampshire Hydro Development Company, proposed a hydro project to generate 1.49 million Kwh annually at the Wiswall Dam, owned by the Town of Durham. *This would be enough power for approximately 30 homes or 5 small businesses.* Seven years later (on June 16th, 1989), with many issues still unresolved, FERC granted a license to Webster, allowing 30 days for appeal. Neither the Town of Durham or the Town of Lee even received formal notification of the license. The Federal Energy Regulatory Commission (FERC) waived the need for a public hearing because the project is a "minor application." The Durham Town Council voted unanimously to appeal the license and pursue Wild and Scenic status for the Lamprey, which would prevent any hydro development. The Town of Lee, the State of New Hampshire, and several individuals also appealed.

In 1991, Congress passed a bill to begin the Wild and Scenic study on the Lamprey, during which the hydro license would be on hold. The Towns of Epping and Newmarket later requested to participate on an "informal" basis in the Wild and Scenic Study. If the Lamprey is not designated Wild and Scenic, the hydro license will become active and construction will begin.

How will it work? Water will be diverted through a penstock into a powerhouse, exiting 200 feet below the dam. Only a minimal amount of water will be left to flow over the dam. Water rights for 7000 feet above the dam will be given to the operator. Although the license states that flashboards are not part of the proposed design, the operator states that he will use flashboards, raising the upstream river by two feet, causing flooding and soil erosion. Flashboards can be added through an amendment to the license that does not require public notice.

Was an Environmental Impact Statement (EIS) done? No. FERC did a minimal assessment, which was never reviewed locally, and which did not consider the effects of raising the river upstream by two feet. FERC also waived the requirement to obtain a Water Quality Certificate from the State of New Hampshire. The Certificate is used to show that a project will not degrade water quality.

Is the project economical? The project currently has a "letter of intent" from a Massachusetts utility to purchase the power at 8 cents per Kwh. Cost of production is estimated to be 8.59 cents per Kwh. There will not be enough water to make electricity during July and August. The project is financially attractive due to certain tax benefits and subsidies for its investors.

Objections to the project: 1) loss of fragile wildlife habitat, 2) the Town of Durham will lose control of the Dam and their water supply, 3) other municipal water supply interestes were not taken into consideration, 4) there is no "greater good." Many people will lose recreational and property rights so 30 houses can get expensive electricity, 5) FERC did not do a proper job of reviewing the project design, finances, or impact on the environment.

Reprint of the Wildcat River (Jackson, NH) Wild and Scenic Designation

100TH CONGRESS
1ST SESSION

S. 1914

To designate the Wildcat River in the State of New Hampshire as a unit of the National Wild and Scenic River System.

IN THE SENATE OF THE UNITED STATES

DECEMBER 3, 1987

Mr. HUMPHREY (for himself, Mr. RUDMAN, and Mr. DURENBERGER) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

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A BILL

To designate the Wildcat River in the State of New Hampshire as a unit of the National Wild and Scenic River System.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That in order to preserve and protect for present and future generations the outstanding scenic, natural, recreational, scientific, historic, and ecological values of the Wildcat River in the State of New Hampshire, section 3(a) of the Wild and Scenic Rivers Act (16 U.S.C. 1274(a)) is amended by adding the following new paragraph at the end:

"( ) WILDCAT RIVER, NEW HAMPSHIRE.—Wildcat River, a 14.51 mile segment including the following tributaries, Wildcat Brook, Bog Brook, and Great Brook (as depicted on a map entitled Wildcat River dated October 1987) to be administered by the Secretary of Agriculture hereinafter referred to as the Secretary. Those segments of the Wildcat River and its tributaries located within the boundary of the White Mountain National Forest shall be managed by the Secretary. Those segments located outside the boundary of the White Mountain National Forest shall be managed by the Secretary through a cooperative agreement with the board of selectmen of the town of Jackson and the State of New Hampshire as described in section 10(e) of this Act. Such agreement shall provide for the long-term protection, preservation, and enhancement of the segment located outside the boundary of the White Mountain National Forest and should be consistent with the river conservation plan as developed by the town of Jackson. To assist with the implementation of this paragraph the Secretary shall establish a Wildcat River Advisory Commission within three months after the date of enactment of this paragraph composed of seven members appointed by the Secretary as follows: one member from among persons nominated by the Governor of the State of New Hampshire; four members to be nominated by the Jackson Board of Selectmen, of which at least two members shall be riparian property owners, and at least one member shall be on the Board of Selectmen; one member to be nominated by the Jackson Conservation Commission; and one member by the Secretary. No lands or interest in lands outside of the boundary of the White Mountain National Forest shall be acquired by the Secretary except by donation. There are authorized to be appropriated such sums as necessary for the purposes of this paragraph.".

SUMMARY OF FINDINGS

Eligibility

The Wild and Scenic River Study for the Lamprey River found that 23.5 miles of the River are eligible for inclusion in the National Wild and Scenic Rivers System based on free-flowing character and the presence of outstanding ecological, anadromous fish, and historical resources. The eligible portion includes 23.5 miles out of 24.4 miles considered in the study, and extends from the Bunker Pond Dam in West Epping to the confluence of the Lamprey and Piscassic rivers in the vicinity of the Newmarket - Durham town line.

Classification

The Wild and Scenic Rivers Act provides for three possible classifications of eligible river segments: wild; scenic; and recreational. The criteria distinguishing these classifications are based on the degree of human modification of the river and its adjacent shorelands. Based on overall context, the most appropriate classification for the entire eligible Lamprey River area is recreational.

Suitability

The 11.5 mile segment of the Lamprey from the southern Lee Town line to the confluence of the Lamprey and Piscassic rivers is found to be suitable for designation as a component of the National Wild and Scenic Rivers System. This segment includes all of the segment authorized for study by P.L. 102-214, plus an additional 1.5-miles studied at the request of the local communities. The additional 12 mile segment of River within the Town of Epping found to be eligible for designation currently meets all of the criteria of suitability except that broad-based local support for the designation has not been expressed.

Principal factors considered in determining suitability for designation are discussed in Chapter IV of this report and relate to an analysis of a segment's potential to be managed and protected effectively as a component of the national river system. These include: adequacy of existing and proposed protection measures; adequacy of existing and proposed management framework; the presence or absence of local support; and the effects of designation.

Support for Designation

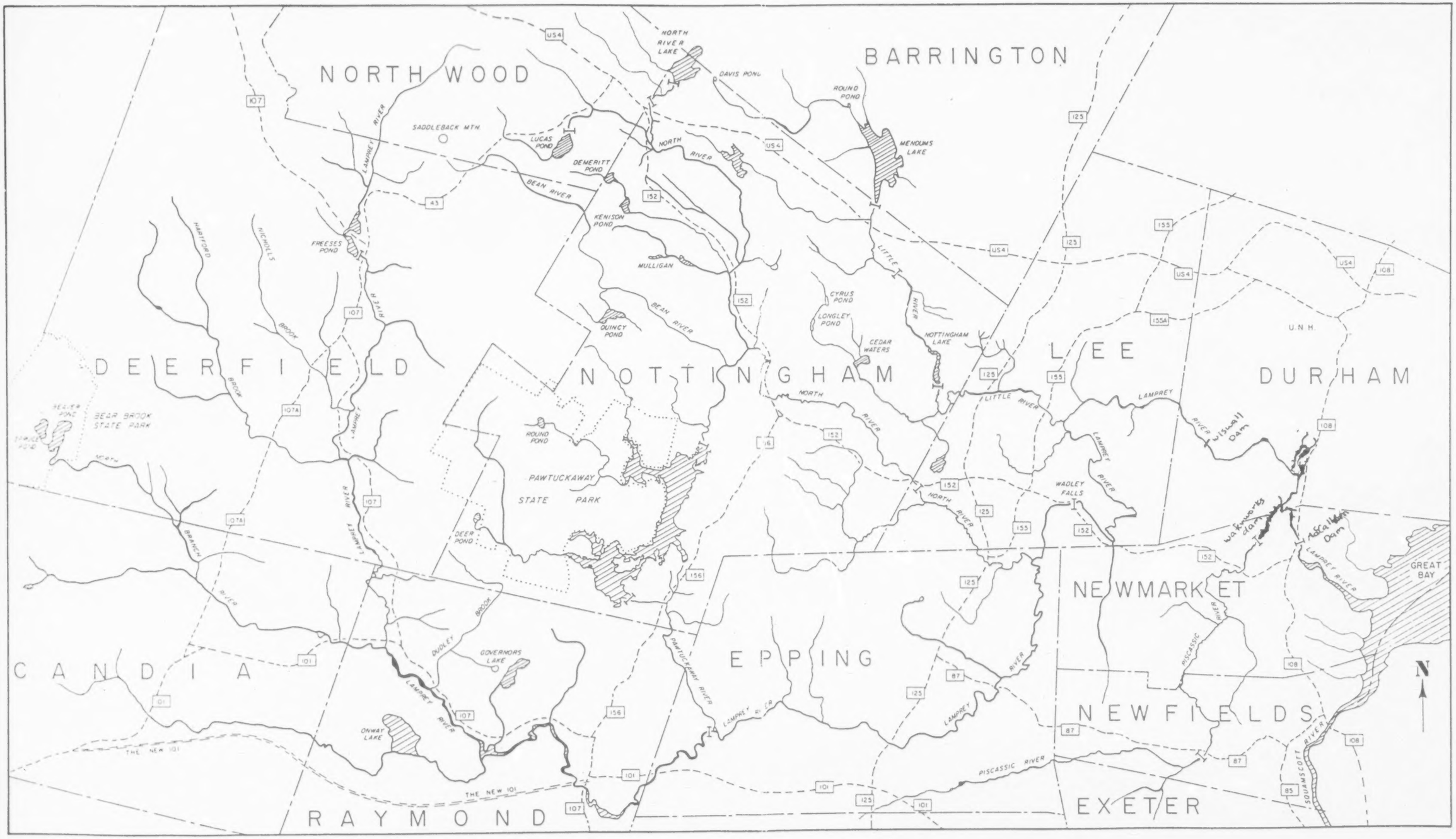
There is strong local support for Wild and Scenic River designation of the Lamprey within the towns of Newmarket, Durham, and Lee, New Hampshire. This corresponds to 11.5 miles of river stretching from the southern Lee town line to the confluence of the Lamprey and Piscassic rivers in the vicinity of the Durham - Newmarket town line.

The town of Epping has chosen to defer formal consideration of Wild and Scenic River designation for the 12 eligible river miles within its boundaries. This segment of river was studied at the request of the town of Epping as an informal addition to the congressionally authorized study segment.

Recommendation

The 11.5 mile segment of Lamprey River from the southern Lee town line to the confluence of the Lamprey and Piscassic rivers is recommended for designation as a recreational river under the National Wild and Scenic Rivers Act to be managed in accordance with the Lamprey River Management Plan completed January 10, 1995. This segment has been found to meet the criteria for eligibility and suitability for such a designation, and the abutting communities have expressed strong support for the designation.

The additional 12 mile segment within the town of Epping has been found to meet the criteria for eligibility for Wild and Scenic River designation, and should be considered for such a designation if and when broad based local support is expressed through town meeting vote.



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